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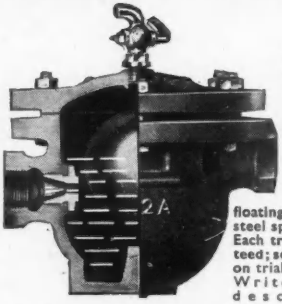

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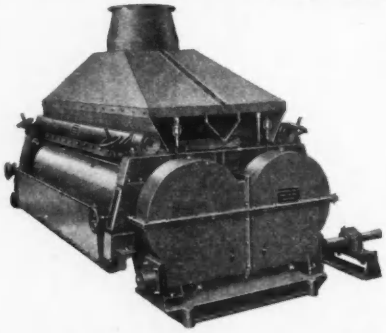

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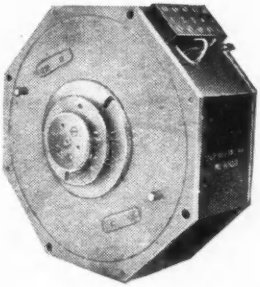

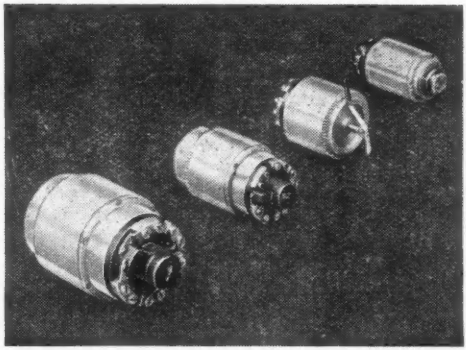

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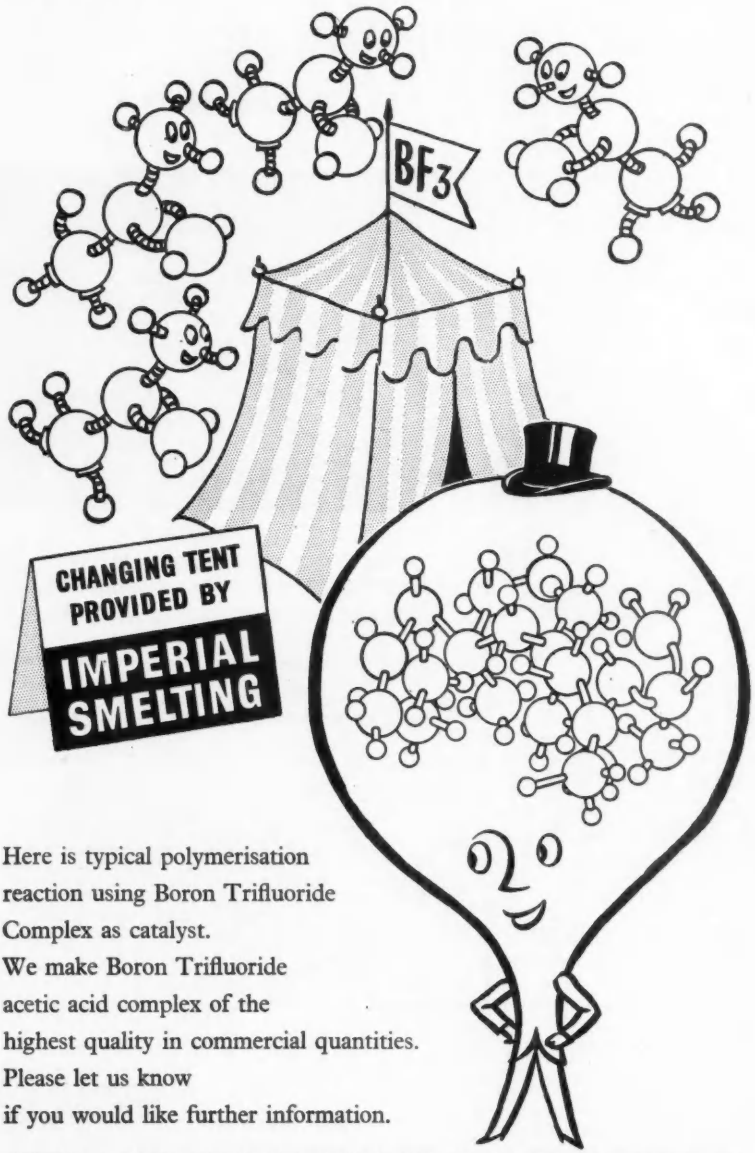

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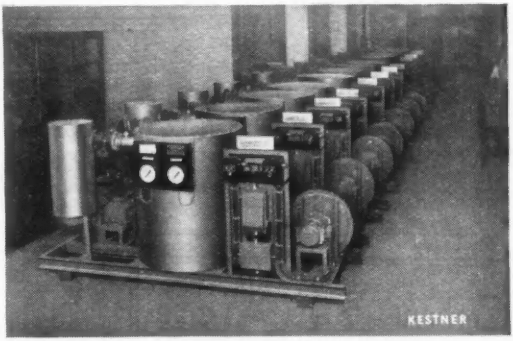

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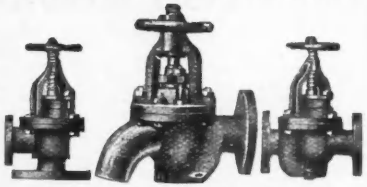

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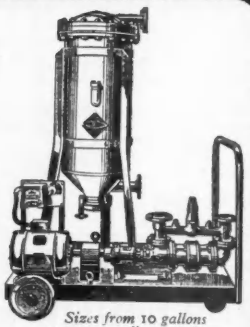

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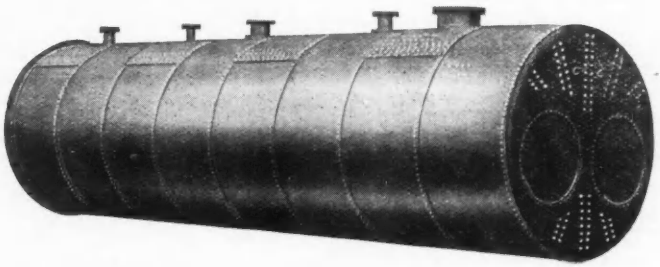

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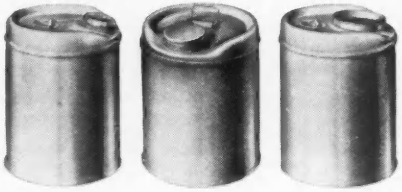

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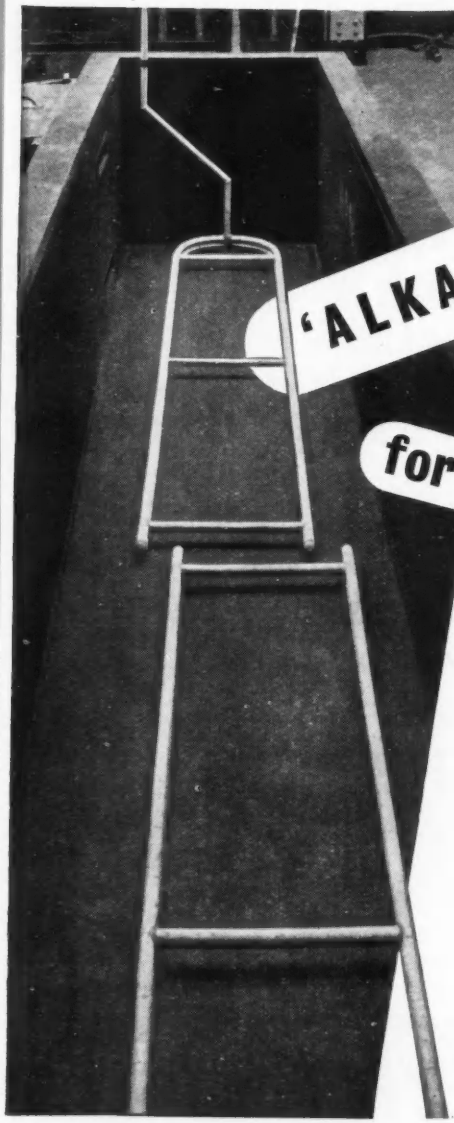

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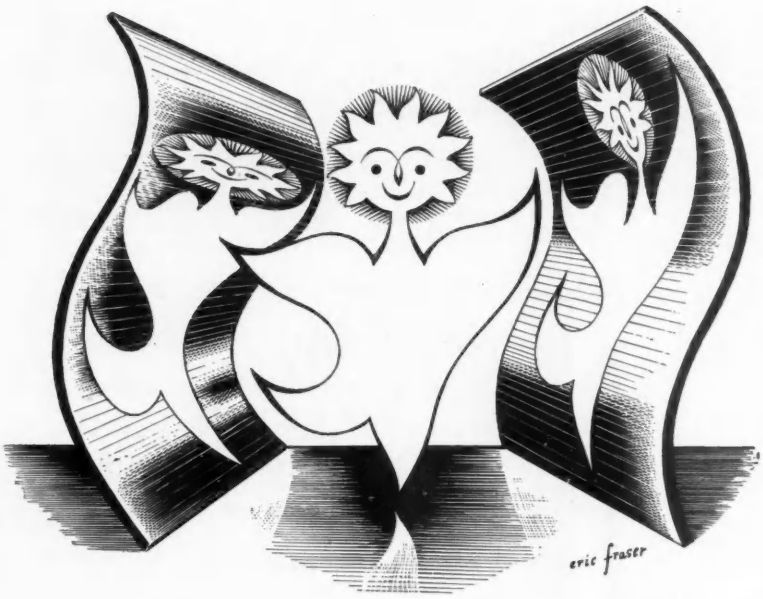

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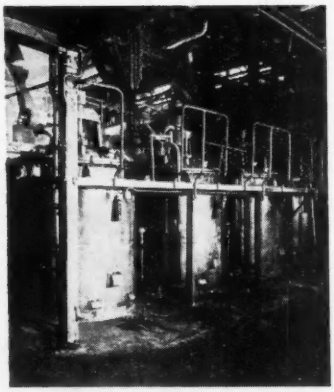

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Volume LXIII 9 September 1950 Number 1626

The Demand for Fertilisers

THE removal of substantial proportions of the subsidies on fertilisers on July 1 has confined most British interest in this subject to the domestic scene. Will fertiliser demand drop as a result the rise in prices? This question has preoccupied manufacturers throughout the year and there is still no firm answer. The latest commodity report from the Food and Agriculture Organisation, which is devoted to fertilisers, indicates that the same question is also being asked in many other parts of the world.

In those countries whose fertiliser industries were not shattered by the war there have been ten years of unparalleled expansion. Likewise, in countries whose factories were severely damaged or whose raw material supplies were cut off, there have been at least five post-war years of vigorous re-building. Consumption in this period has been limited only by production. The FAO report says that now " for the first time since the war, world supplies of most fertilisers are sufficient to meet effective world demand," and expresses the opinion that " the present is an important period of transition in the world production and consumption of commercial fertilisers."

Three separate factors influence the volume of fertiliser consumption. These are the tonnage made available, the tonnage required for the agronomic needs of crops and soils, and the total amount farmers are prepared to invest. The second factor, though idealistic from the technical standpoint, has never yet been able to exert the dominant influence. Throughout the recent years of expansion the first factor has ruled the market; the tonnages applied to the world's soils have been as large as they could be, but never within any distance of the tonnages ideally required for optimum cropping. Now, the third and economic factor has returned. The FAO report indicates that factors other than supply are slowing down the demand for all fertilisers. In some areas less favourable relationships between agricultural and fertiliser prices are an important adverse influence. The inability to purchase because of the financial considerations has kept some countries from meeting fully their import requirements. It is expected that during 1950-51 such factors will tend to exert more influence on the amount of fertilisers consumed than will either the actual agronomic needs, or the status of the world's supply.

It is unlikely that there will be any immediate recession in fertiliser con-

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sumption. Indeed, estimates collected by FAO from most governments indicate that there will be a 7 per cent rise in both output and use during 1950-51. Estimates at a time of transition are, however, liable to be uncertain guides. All manufacturers will have planned for continued increases in output and sales but they can quickly curtail production if demand itself declines. The chances of continued expansion seem brightest in Europe, where the biggest increases, both as percentages and as real tonnages, have been shown in 1948-49 and 1949-50. By comparison, the tonnage increases in America have been small and those in Asia and Africa insignificant. The expansive force in Europe must still carry a considerable momentum. Also, most European countries are determined to produce as high a proportion of their total food needs as possible and for such plans as these fertilisers are indispensable. Nor is the economic factor seriously worsened in Europe by hard currency complications.

Europe, as a whole, produces more than its own requirements of potash and nitrogen, and its phosphate mineral needs can be met from North African deposits. It may be feared that the effects of de-subsidisation in this country will be restrictive, but it should be remembered that some other European countries discarded their wartime fertiliser subsidies two or three years ago.

The most serious consequences of any recession in fertiliser demand will be manifest in Asia, Africa, and possibly in South America. In these under-developed areas the total tonnage of fertilisers used is still very much less than that desirable, both for good rates of cropping and for soil conservation. In recent years there has been steady expansion, particularly in Asia, and it seems essential for this trend to continue. The technical or agronomic influence has to combat many prejudices in these areas and the progress made since 1948, which may not represent large tonnages by European or American standards, is certainly a notable scientific and administrative achievement. It would be a tragedy if these developments were halted by the intervention of economic factors. Food is, or should be, the birthright of all and the direct means of growing better crops must be made available to the worst-nourished populations of the world.

Notes and Comments

Benzol Sources

AS an instance of the permanent practical benefits in peacetime of co-operative work for wartime needs the full report on benzol and toluene from British coal gas undertakings seems to be outstanding. The regrettable likelihood that the clamant demand for these essentials in many departments of industrial chemistry will be accentuated by a rearmament programme heightens the value of the studies of common production methods and possible improvement and of the value in this connection of different regional coal resources. The detailed results relating to such practical aspects will certainly commend the report to those in industry at least as warmly as the statistical sections will appeal to those who need only the statistics. Government interest in promoting industrial efficiency seldom operates as effectively as did this investigation, for which the Gas Light and Coke Company in 1941 made their experts available to the Ministry of Fuel, until the work was completed in November, 1945, after 644 visits to gas works. The better yields of benzol from coke oven plants in general was recognised by their virtual exclusion from this survey. One of the facts which emerge conspicuously from this report is the scope which existed in 1941, and possibly has not yet been fully exploited, to raise benzol yields by the employment of more up-to-date plant and methods and by greater discrimination in the choice of coals. That possibility is emphasised by what was achieved in four war years, 1939-1943, during which gas works raised their output of crude benzol from 24.3 to 39.4 million gallons a year.

Technical Training

HARD upon the news that the Parliamentary and Scientific Committee has recommended an all-round general increase in the training facilities for young technicians in Great Britain comes the report of the United Kingdom Mission to Pakistan, in which one of the suggestions is that suitably trained men be sent to Pakistan "to train the factory workers and to see the factories through their initial troubles." A question put by a CHEMICAL AGE representative at a Board of Trade Press conference last week as to how this latter proposal can be reconciled with the recommendations of the Parliamentary and Scientific Committee met with the answer that the British technicians would be allowed to go for "as short a period as possible." This statement, coupled with the further suggestion by the mission that Pakistan student technologists in the U.K. be allowed greater facilities for study, leads one to believe that in the matter of economic and technical recovery Britain must needs dissipate her resources in sending skilled men out of the country during a period when they will be needed most and at the same time allowing the already overcrowded training facilities in the U.K. to become even more so. This does not seem fair to the young people about to enter British industry, who will require all the help and teaching that our skilled workers and technologists can give during their apprenticeships and trade courses. There can, of course, be no suggestion that anyone denies the people of Pakistan the right to set up factories and plants with the aid of British skill. It is merely a question of what form that aid will take. It would be most unwise to allow any official scheme for the training of Pakistani personnel, either in this country or in Pakistan, to interfere with projected expansions of training facilities for British workers.

Summer School for Analysts

THE inability of normal educational systems to deal amply, sometimes even adequately, with the current multiplication and refinements of the techniques of chemistry, is again recalled by the keen and widespread

response to the summer school in analytical chemistry which has been in progress in London this week. Even more significant than the numbers who registered for this pioneer attempt to provide for analysts the kind of supplementary study made available in some other science departments, in the countrywide distribution of those attending it. While analytical chemists are training in all parts of the British Isles, it is highly unlikely that more than a few would in present conditions think it worth transporting themselves to London for a week from places as remote as Wick, Edinburgh and Swansea—as numbers have done on this occasion—if familiarity with various aspects of polarography, absorption and emission spectroscopy, organic microanalysis and radiochemical analysis could be acquired in vacation nearer home. That is no criticism of the admirable provincial training centres. It does, however, call to mind the increasing complexity of the analyst's training needs imposed by the introduction of new techniques, most of which are characterised by their time-saving and so are becoming indispensable. By mustering an authoritative panel of lecturers on these and similar subjects the London and S.E. Counties section of the Royal Institute of Chemistry and their collaborators, the Society of Public Analysts and other Analytical Chemists, have provided another aspect of private, and entirely voluntary enterprise in supplying a need which will certainly be no less urgent in future years.

Seaweed Chemicals

A RECENT report in *The Times has* once again drawn attention to the value of seaweed research in revealing new potentialities of wealth around the coasts of Great Britain. In about a year's time it is estimated the Scottish Seaweed Research Association may be able to assess fully the true economics of chemical production from algae. It will be recalled that Lord Bilsland, chairman of the Scottish Council (Development and Industry) recently expressed the fear that others might be more active than we in utilising the results of these researches. The number of firms processing and marketing seaweed has trebled in four years, while there has been a six-fold increase in the number of collectors. Lord Bilsland estimated that the output of the five British firms producing alginates and agar is worth £700,000 per annum. A concrete advance is represented by the fact that attention has been diverted from the wasteful burning of seaweed, with iodine as the sole product, to chemical treatment for the extraction of organic chemicals. The researches which led to the substitution of the pre-war Japanese agar are now a minor classic. In place of the *Gelidium* red algae, methods based on *Chondrus crispus* and *Gigartina stellata* were developed. Various grades of agar were produced suitable for bacteriology, the testing of penicillin, the replacement of gelatin and pectin in foods, and for application in edible and pharmaceutical "creams." This British agar substitute proved in some respects—in ease of solution and by having a lower melting point—to be an improvement on the Japanese material. There is ample evidence that chemists and chemical engineers have been equal to all the problems presented so far. Large-scale mechanical harvesting, however, remains a study in which much more work remains to be done.

Test Borings for Lead

FIRST test borings are soon to be made on the stretch of moorland between Wirksworth and Matlock, Derbyshire, in an attempt to decide finally whether the lead mines in the locality have economic possibilities. This is the second stage of the enterprise by the Derbyshire Stone Co. and the £12.7 million scheme of the Johannesburg Consolidated Investment Co. and follows almost six months of geological survey work. Experts have named sites where it is believed lead seams are thick. If these are confirmed new shafts will probably be sunk as a more economic proposition than developing old ones. Work is centred on the Magpie Mine, which has been derelict for 30 years and has never been explored with the resources available to modern mining.

£20 m. MORE FOR CHEMICALS

Finance for Expansion of I.C.I.

THE second of the exceptionally large additions to the funds employed by chemical industries in this country is foreshadowed by last week's announcement by I.C.I., Ltd., that it had received the consent of the Capital Issues Committee to issue £20 million 4 per cent unsecured loan stock.

This is to be secured by a private placing in the London market of unsecured loan stock redeemable at par in 1960, or at 101½ in 1958 or 101¼ in 1959, should the company wish to clear the loan earlier. It will bring to a total of £40 million the new capital acquired by I.C.I. since the war, the need for which is fully explained by the almost unparalleled scale of the expansion schemes projected or in progress of several of the chemical and metal divisions, the continued enlargement of the research programmes and the facilities for them, and I.C.I.'s participation in the new enterprises for the production here of refined petroleum and petroleum derivatives. The previous addition to I.C.I. funds also procured £20 million, on that occasion readily subscribed by stockholders invited to take up one new ordinary £1 share for each five already held, at a price of 40s. 6d. The alacrity with which that capital was subscribed provided remarkable confirmation of the confidence of further prosperity for large-scale chemical enterprise.

Plant *versus* Arms Production

SOME Scottish chemical engineering concerns are advising customers at home and abroad that requirements over the next two years should be ordered now. The advice has been given in the light of experience in 1939 when armament production went into gear. Firms in the engineering industries which were then given specific duties could again be called on to handle armament and component work.

The orders which were on the books during the last period of rearming were permitted to go through; many were in a semi-completed stage. Chemical engineers foresee that they are likely to be brought in, to a greater or less extent, on armament production and that some curtailment of plant manufacture would be inevitable. They anticipate that priority will continue to go to export orders, for which a substantial volume of business remains on hand.

PETROCHEMICALS' FUNDS

Need for Further Capital

THE excess of plant costs over estimates was largely responsible for the need for more money announced by Petrochemicals, Ltd. A further £2½ million is required by the company which is constructing a chemicals-from-oil plant at Partington, near Manchester. Out of this additional capital £900,000 will be temporary advances from the Finance Corporation for Industry, and will be repaid.

Sir Robert Renwick, the chairman who was appointed some weeks ago at the request of the Finance Corporation for Industry, gave his opinion that the basic conception of the Catarole plant was sound.

The novel nature of much of the machinery required had added to expenditure. This was particularly so in the case of the plant necessary for the separation of gases produced in the cracking furnaces and then utilised for the production of the most valuable end products of the whole set-up. The gas plant is now capable of producing the separated gases required for the ethylene and propylene conversion plants which should shortly be coming into operation.

Estimated cost of the project was expected to be £4.3 million, including £220,000 for working capital. With the £2.5 million now required, the total capital involved will be nearly £10 million. Devaluation has increased the cost of basic materials, fuels and certain chemicals by nearly £450,000 a year.

Chemical Exports to Turkey

THE third most important group of imports into Turkey from Britain consists of dyestuffs, chemicals and pharmaceuticals, states an article in the current week's *Board of Trade Journal*, on the development of U.K. trade with Turkey. In general, British products meet Turkey's requirements satisfactorily in all these lines, in which before the war Germany held about 90 per cent of the market, but British manufacturers must expect to have difficulty in maintaining the position they have gained, in view of the revival of German competition.

The total value of British exports to Turkey in 1949 under the category of "chemicals, drugs, dyes and colours" was £956,895, compared with £1,169,177 in 1948 and £798,893 in 1947. Roughly one-fifth of the 1949 figure was for "finished dyestuffs obtained from coal tar."

Instruments for Export

SIMA Report on Packaging Failures

THE consistent bulk and value of Britain's exports of scientific instruments (THE CHEMICAL AGE, *63*, 285) lends point to the practical suggestions offered, at the recent annual general meeting of the Scientific Instrument Manufacturers' Association for improved methods of packing.

Discussion of this was stimulated by the chairman's disclosure that general complaints had recently been received from abroad, and in particular Australia, of the unsatisfactory condition in which instruments were arriving at their destinations.

Feeling in this matter was reported to be so strong that countries at the present time importing from this country were expressing a general desire to buy instruments from America as soon as the dollar situation became easier unless the quality of British packing substantially improved. Not only did instruments arrive in damaged condition, but considerable money and time had to be expended before the instruments could be satisfactorily unpacked and made ready for use.

It was suggested that the materials used in packing were frequently unnecessarily bulky and unsuitable. Wood wool, for instance, although tightly wedged during the operation of packing, would easily compress and shift during a long journey overseas, thus exposing the instrument to shock and moisture. In addition, the large quantities of materials such as wood wool required to pack an instrument presented a severe encumbrance to the receiver.

The SIMA report notes that the Americans, who held an enormous lead in protective packing, often employed light-weight cartons for the transport of instruments, and it might well be that what was needed in this country was not so much an improved method of packing as a more scientific one. Carton packing was used by other industries in this country with complete safety and effectiveness. Every day in goods yards and haulage departments radio sets, glassware, fragile and even heavy equipment were being transported in cartons, with no evidence of the bulk crates and boxes so widely identified with the instrument manufacturer.

Experiments were showing that light-weight packing materials could be safely used and that they afforded ample protection for even delicate instruments. Rubber mountings and simple devices with welded rubber joints could be substituted for wood and other fillings. Cellophane wrappings for instruments could be used in order that Customs inspection might be made without disturbing the protective outer layers. Expensive packing materials were not necessarily the best and research and experiment might provide new methods of scientific packing which were both cheaper and more effective.

Drug Sales to Australia

THE prospect of substantially larger sales of drugs to Australia is associated with the acceptance there of a modified system of distributing free medicine which came into operation this week in the Commonwealth. Free distribution is confined to 185 costly drugs. These include all the sulpha drugs, penicillin, insulin, and vitamin B_{12}, used in the treatment of anæmia.

Members of the British Medical Association, who opposed the first scheme to give free distribution of about 600 prescriptions, because it would have limited the practitioner's discretion in the treatment of patients, are co-operating unreservedly in the new scheme.

Official overseas trade figures for 1949 show an item of £153,806 worth of proprietary medicines exported by Great Britain to Australia.

Too Few Applied Scientists

SIR EWART SMITH, director of I.C.I., Ltd., speaking before the British Association in Birmingham this week, emphasised that neglect to make applied science and technology widely available to industry had greatly retarded industrial progress in this country. He contrasted the situation here with that in the U.S.A., which, industrially, now enjoyed the pre-eminence that once belonged to this country. That circumstance was directly connected with the rate at which applied scientists were trained and used in industry. Between the wars, in Great Britain the ratio of first degrees in all faculties was 1.5 per 100,000. In the U.S.A. that ratio had increased to 8. Pure science here still predominated over applied science, so that we continued to make knowledge available, leaving its development to other countries.

BENZOL PRODUCTION

Four Years' Study of Gas Works Processes

THE most comprehensive review of the technical aspects of benzol production at gas works employing many different coals and differing in many respects in procedure is provided in the publication by the Ministry of Fuel this week of the results of four years' study by fuel technologists. (Benzol and Toluene from Coal Gas. Report on technical work 1941-1948; 5s. 6d.).

The technologists, seconded to the Ministry, began their survey during the war, in November, 1941, and concluded it in November, 1945. Over 300 gas works were visited and, as a result of these tests, a great deal of valuable information of scientific interest was obtained, which will be of value not only to fuel technologists in the gas, oil and coke oven industries but all industries, both in the United Kingdom and abroad.

The report includes 23 large tables of results, giving a complete picture of the benzol and larger carbonising plants in Great Britain and Northern Ireland.

Each test involved the actual measurement of the benzol and toluene in the gases entering and leaving a benzol plant over a period of at least 16 hours. These experimental figures were then compared with those calculated from the known operational data and a great many scientific facts of value were disclosed.

The report makes available new information relating to the yields of benzol and of toluene obtainable from various British coals in various types of carbonising plant. It shows that the production of toluene was greatest from intermittent vertical retorts and gives the yields of benzol and toluene from many carburetted water gas plants, from a few Tully plants and from one low temperature carbonisation plant. Analyses of the benzols are given, with specific gravities of both benzols and toluoles. Correlation with carbonisation can be made for each test as full details are given of the dimensions and operating conditions of the carbonising plant.

Results for the recovery of benzol have been made available from tests carried out at all the works visited, including 41 tests on active carbon plants.

Information and comments are given on many aspects of production. The subjects include: the amounts of higher boiling materials in benzols produced from coal gas and carburetted water gas; on the types of benzol plant in use in December, 1945; on partition coefficients; on test methods; on washer and still efficiencies; on tower scrubbers; on packings in tower scrubbers; on new types of two-stage tower scrubbers; on the effect of re-circulation of oil in rotary washers; on benzole recovery in a washer operating under pressure; on unusual washers, stills and packings; on methods of operation to obtain optimum recovery of toluene; on "wet" stills; on the effect of seasonal changes in temperature; on the design and layout of plants; on instrumentation; on the effect of sludge; on the "wash-oil" content of recovered benzols; on the removal of intermediate fractions and phlegm oil; on attempts made to obtain restricted benzol recoveries on active carbon plants; on the effects of stripped gas on the distribution system and on methods of calculating recoveries from known operating conditions.

Reduced Scale of U.S. Chemical Exports

AMERICAN chemical exports in the first quarter of 1950 declined 20 per cent from similar exports during the same 1949 period. Shipments, valued at $182 million, were 12 per cent less than in the last quarter of 1949 and were the lowest for any quarter since 1947. American chemical exports are expected to continue the downward trend, at least for the balance of the year, according to the government bureau.

Medicinals and chemical specialities were the two largest export categories in the first quarter, accounting for more than 46 per cent of the total. Exports of industrial chemicals and coal-tar products showed sharp declines—of 39 and 56 per cent, respectively. Fertilisers, however, showed an increase, to $24,523,000 as compared with $22,855,000 in 1949. Paint exports were $19,322,000. Naval stores totalled $5,318,000, and sulphur exports were $7,162,000.

North America replaced Europe as the major market for U.S. chemicals. Chemical shipments to the United Kingdom dropped almost 50 per cent.

Rising Demand for Non-Ferrous Metals

Abnormal Request for Copper

CONSUMPTION of non-ferrous metals in the United Kingdom in July was higher than in the corresponding month last year, with the exception of tin which was slightly reduced. Closing stocks of lead improved, but those of unwrought copper (both blister and refined) were reduced.

UNWROUGHT COPPER

	Long Tons Blister Copper	Refined Copper
OPENING STOCKS:		
Govt. and consumers'	46,204	78,992
Imports	13,684	15,132
PRODUCTION:		
Primary	—	11,988
Secondary	1,989*	5,401
CONSUMPTION:		
Primary	12,128	26,538
Secondary	—	15,129
Exports	1,205†	1
CLOSING STOCKS:		
Govt. and consumers'	49,559	77,312

* Rough copper.

† Includes 904 tons of rough copper despatched to Belgium and 301 tons of rough copper to Germany for refining on toll.

GROSS OUTPUT OF MAIN COPPER, ALLOY AND PRODUCTS

Unalloyed copper products	24,629 long tons
Alloyed copper products	24,046 ,, ,,
Copper sulphate	4,708 ,, ,,

UNWROUGHT ZINC

	Long Tons Zinc in Concentrates (estimated gross Zinc content)	Slab Zinc (all grades)
OPENING STOCKS:		
Govt. and consumers'	29,316	25,272
Imports	14,474	18,870
PRODUCTION:		
Virgin and remelted	—	5,407
CONSUMPTION:		
Virgin (incl. debased)	6,388	19,066
Remelted and scrap	—	7,381
Exports and re-export	4	1
CLOSING STOCKS:		
Govt. and consumers'	37,398	58,168

Production figures for the month were generally marked by an improvement, but the most outstanding item was lead, the figures being: concentrates 228 (37); English refined 5482 (2656).

Details given below are abstracted from the summary supplied by the British Bureau of Non-Ferrous Metal Statistics.

LEAD

	Long Tons Lead in Concentrates	Imported Virgin Lead	English Refined	Lead Content of secondary Scrap and Residues
OPENING STOCKS:				
Govt. and consumers' ...	—	67,857	6,262	—
Other stocks ...	72	—	—	—
IMPORTS	—	13,813	—	361
PRODUCTION ...	228	—	5,482	—
CONSUMPTION ...	253	12,409	5,751	7,435
EXPORTS	—	15	—	—
CLOSING STOCKS:				
Govt. and consumers' ...	—	68,001	5,993	—
Other stocks ...	65	—	—	—

TIN METAL

	Long Tons
GOVT. AND CONSUMERS' STOCKS (at end of period)	9,067
IMPORTS	—
PRODUCTION	—
CONSUMPTION	1,873
EXPORTS AND RE-EXPORTS	3,203

ANTIMONY

	Long Tons
TOTAL CONSUMPTION OF ANTIMONY METAL AND COMPOUNDS	386
TOTAL CONSUMPTION OF ANTIMONY IN SCRAP	251

CADMIUM

	Long Tons
TOTAL CONSUMPTION OF CADMIUM	47.25

Further Increases in Copper Prices

THE price of U.K. copper was raised on August 31, by £16, from £186 to £202 a ton. Discounts premiums and forward charges remain unchanged. This followed an increase in the New York copper quotation. The Ministry of Supply announced that as from September 4, its buying price for rough copper in slabs of from 2 to 3 cwt. is increased from £144 to £156 a ton.

Abnormal purchases of copper, lead and zinc in the present volatile state of the market are considered by the Ministry of Supply to be unnecessary and undesirable.

To discourage excessive forward buying the Ministry has announced that additional charges for forward purchases would be increased as follows:—

	2nd and 3rd months after month of order	Previously	4th, 5th and 6th months after month of order	Previously
	£ s.	£ s.	£ s.	£ s.
Copper	13 10	1 10	15 0	3 0
Lead	7 0	1 0	8 0	2 0
Zinc—	13 0	1 0	14 0	2 0

NEW ATOMIC PARTICLES DISCOVERED

Professor Blackett's Disclosure to the B.A.

DISCOVERY of two new atomic particles was announced this week by Professor P. M. S. Blackett at the annual conference of the British Association now in progress at Birmingham.

Cloud chamber photographs of the disintegration of very heavy unstable mesons taken both by Carl Anderson at Pasadena and by the British research team at the observatory some 9000 ft. up the Pic du Midi, were shown by the professor.

Two pictures taken in 1947 by Rochester and Butler first suggested the discovery, which seemed to indicate the existence of about 900 electron masses, which were spontaneously unstable. One was neutral and decayed into two charged particles, and the other was positive and decayed into a positive and a neutral.

This has since been confirmed by 34 more photographs taken at Pasadena, where the masses of the new particles have been estimated to be between 250 and 400 electron masses larger than the sum of the masses of the particles into which they decayed. In agreement with the American investigators, the new large mesons had been named V-particles. Anderson had suggested that some of them might be protons, but this was not yet confirmed.

The products of their disintegration were pi-mesons, which formed so much more familiar feature of cosmic radiation. Professor Blackett did not think we were yet able to estimate the lifetime of these V-particles.

Acceleration of Particles

One of the most popular sections was the mathematical one, at which the discussion of nuclear physics attracted a large audience, the majority of which consisted of the lay public and students.

The series of papers on "High Energy Particles and Machines for their Acceleration," was opened by Professor R. E. Peierls. Techniques that had led to the construction of machines that could accelerate particles to energies of a few hundred million electron volts were described, and the possibility referred to of developing machines to reach the region of a few thousand million electron volts.

A closer knowledge of the emission of light was essential to a clear understanding of the electric forces that governed the motion of electrons in atoms, said the professor. Faster particles would help to solve the problem of whether the proton—that is, the hydrogen nucleus—possessed, like the electron, a counterpart of opposite charge.

Recent developments in the linear accelerator, which has been modified to accelerate electrons, were described by Mr. D. W. Fry, of the Harwell Research Observatory, where it is used as a pulsed neutron source.

An account of the proton synchroton under construction at Birmingham was given by Dr. L. H. Hibbard. This is designed to accelerate protons to over 1000 million electron volts. After travelling 120,000 miles round the orbit of the machine the protons will reach a speed of 91 per cent of that of light.

Cosmic Ray Research

FOUR British scientists are to spend the winter at the research station on the Jungfraujoch—11,700 ft. high, and one of the highest in the world—where they will continue researches into the properties of tau-mesons, the showers of newly discovered penetrating particles produced when the atom is broken by cosmic rays.

The team from Manchester University is expected to arrive next month and will start its researches in November. The leader will be Mr. A. J. Newth, and the work will be under the general supervision of Professor P. M. S. Blackett.

A Wilson Cloud Chamber and a 14-ton magnet will be among the heavy equipment brought by the scientists. Cosmic ray phenomena produced in the cloud chamber occurs approximately 20 times more frequently at the height of the research station than in British cities.

Another party of scientists from Bristol University under Professor C. F. Powell, is expected to visit the Jungfraujoch during the winter to photograph the trajectories of radioactive particles by a different method.

New Plants in Israel

Israel plans the erection of a cement factory near Hadera in addition to the Nesher Cement Works, the production of which has reached 26,000 tons per month. A plastic factory has begun production at Bnei Brek, near Tel-Aviv.

ANGLO-U.S. REFINERY

Powell Duffryn and Vacuum Oil Co.

THE boards of Powell Duffryn, Ltd., and of Socony-Vacuum Oil Co., Inc., of New York, have indicated that the collaboration foreshadowed in a joint statement in March has taken effect and that the property at Coryton formerly owned by Cory Brothers & Co., Ltd., has now been acquired by Vacuum Oil Co., Ltd. From September 1 the business previously carried on at Coryton by Cory Brothers is being continued by the Vacuum company as an addition to its present business.

The board of directors of Vacuum Oil Co., Ltd., has been enlarged by the addition of four Powell Duffryn Group nominees and now consists of Mr. J. C. Gridley (chairman), Mr. H. W. Rocke (managing director), Mr. J. S. Vesey Brown, Mr. W. M. Codrington, Mr. Charles Lawrie, Sir Herbert Merrett, Mr. J. Blake Middleton (U.S.A.), Mr. Miles Reid and Mr. H. V. Vale.

Work Begins at Coryton

The preliminary design work for the construction of the new oil refinery at Coryton has been completed and the necessary consents have been obtained. The Lummus Co., Ltd., petroleum industry engineers, have been appointed principal contractors to the refinery project. Work on the building of roads and the extension of the existing private railway has been started. The target date for the completion of the refinery is January 1, 1953. Practically the whole of the plant and equipment will be manufactured in this country.

The expenditure on the refinery and on other works at Coryton and elsewhere will be financed in part by Powell Duffryn and Socony-Vacuum. The Finance Corporation for Industry, Ltd., will make available the balance required for the construction programme.

Oil Prices Increased

THE maximum prices of gas (diesel) oil and Derv oil for road vehicles were increased by three-eighths of a penny a gallon on September 4. The new rates are these :—

Gas oil (diesel oil) : Inner zone, 1s.; outer zone, 1s. ¼d.; general zone, 1s. ½d.

Derv : Inner zone, 2s. 6⅜d.; outer zone, 2s. 7d.; general zone, 2s. 7¼d.

All these prices refer to bulk deliveries by oil companies.

YOUNG CHEMISTS' ESSAYS

Good Performance Rewarded

AT the conclusion of his presidential address to the British Association at Birmingham last week, Sir Harold Hartley announced the names of the prize-winners in the scientific essay competition which has been sponsored by *Endeavour*, the quarterly science review published by Imperial Chemical Industries, Ltd.

The competition, of which details were announced in February, was for young scientists only, with the object of stimulating their interest in the work of the British Association and encouraging the writing of good English. There was an age limit of 25 years for all competitors. Competitors had to write a 4000-word essay on one of twelve given subjects.

Good Response

The response was considerably greater than was anticipated. 117 essays were submitted and the very high standard of the great majority made the judges' task extremely difficult. The prize-winners are as follows :—

The 50 gns. is awarded to 24-year-old W. J. T. Dunstan for an essay on "Phenomena at Low Temperatures." He was educated at Stratford Grammar School, London, and at Wadham College, Oxford. In 1946 he became assistant in physics at University College, Dundee, and last year was appointed lecturer in physics at Northern Polytechnic, London.

The second prize of 25 gns. is awarded to 22-year-old S. J. Adelstein for an essay on "The Biological Significance of Trace Elements." He is an American citizen and a graduate of the Massachusetts Institute of Technology.

The third prize of 10 gns. is awarded to 23-year-old F. J. C. Rossotti for an essay on "Radioactive Tracers." He won an Open Postmaster scholarship to Merton College, Oxford, from Christ's Hospital, Horsham.

In addition, a special prize of five guineas has been awarded to 17-year-old R. D. Cohen, of Clifton College, who sent in an entry of unusual merit for so young a competitor.

I.C.I. Resumes Mineral Search

Hoping to procure potassium brine and natural gas in sufficient quantities for use at their new Wilton factories, I.C.I., Ltd. has resumed boring at Eskdale Gate Farm, near Whitby. Similar operations are to be started by the company at nearby Rockhead Farm, Skelder.

THE SIGNIFICANCE OF CHROMATOGRAPHY

"Greatest Single Advance in Chemical Technique"

THE advancement of science depends on many things, but not least on the perfection of new techniques for collecting the facts from which new discoveries may arise. In chemistry the last fifteen years have seen the development of a new technique—chromatography—which has proved of the greatest value and led to important progress in almost every branch of the subject, said Dr. Trevor I. Williams, deputy editor of *Endeavour*, in the course of his paper read before the chemistry section at the British Association's meetings in Birmingham on Monday this week.

Many, indeed, see in chromatography the greatest single advance in chemical technique of this century, said Dr. Williams. The method was originally discovered about fifty years ago by a botanist, Michael Tswett, of Warsaw University, who used it with great success for analysing the various important pigments—such as chlorophyll—which are present in plants. He discovered that when a solution containing different pigments is allowed to percolate under special conditions through a column of powder—such as fuller's earth—contained in a glass tube, the different pigments separate in bands at different levels on the column.

Unfortunately the importance of Tswett's discovery was not generally recognised at the time, and it was many years before chemists began to make use of it. In 1931 it was applied with great success to studying the properties of natural pigments related to Vitamin A. The success of chromatography in this very important research at once attracted the attention of chemists all over the world and thereafter chromatography became increasingly widely used.

Partition Chromatography

In 1941 chromatography received a great stimulus when the British research chemists Dr. A. J. P. Martin and Dr. R. L. M. Synge invented a completely new type of chromatography which they called "partition chromatography". This has been exceedingly valuable, especially in the medical field. It has been applied particularly to the study of substances called amino-acids, the single building bricks from which all proteins are built up. A great feature of the new method is the extremely tiny quantities of material needed for analysis; a single hair or a small drop of blood are, for example, sufficient. The great importance of this work was marked earlier this year by the election of both Dr. Martin and Dr. Synge to Fellowship of the Royal Society.

Dr. Williams referred to the account of this important new method and its results which would be given later that day in the chemistry section by Dr. C. E. Dent, of University College Hospital Medical School, London, who had used it very extensively as an adjunct to medical research and had made important contributions of his own, especially in studying the composition of the body fluids.

Great Possibilities

In this field, continued Dr. Williams, it is no exageration to say that chromatography is opening up a new world of investigation. In the form in which Dr. Dent and most other research workers are using partition chromatography, a sheet of blotting paper is the material on which the analysis is made. With the aid of various solvents the constituents of a mixture are spread out so that each occupies a different spot on the paper.

The chromatographic analysis of inorganic substances came to prominence during the war, although for reasons of secrecy the great progress made was not disclosed until the end of 1947. For the purposes of chemical and biological examination it was necessary to separate the very tiny quantities of fission products which were obtained in the various atomic energy projects. Chromatography alone proved generally capable of separating these minute amounts and an additional form of the method was developed in which the analyses were made on columns of substances very similar to those used in ordinary domestic water-softeners.

This form of chromatography is called "ion-exchange chromatography". The method has revolutionised the separation of important metals known to chemists as the "rare earths". The similarity of these formerly made their separation a matter of months or even years of laborious work; now many of them can be separated by chromatography in a few hours.

ION-EXCHANGE RESINS

Their Many Practical Developments and Possibilities

From A CORRESPONDENT

THE exchange of cations between a solid and a solution was first demonstrated exactly a century ago. At that period there was much interest in the behaviour of synthetic fertilisers in soil. An explanation was sought for the observation that ammonium and potassium cations, added as soluble salts, were tenaciously held in soil despite the leaching effect of rain-water.

Ammonium Ions Retained

In 1850 Thompson showed that when aqueous solutions of ammonium salts were passed through a bed of soil in a column, the ammonium ions were retained by the soil and the effluent solution contained calcium and magnesium ions. This original observation was confirmed and greatly extended by the work of Way, who proved that cations other than ammonium were absorbed by soil, an equivalent amount of calcium being released. Later, Way prepared in the laboratory a hydrated sodium alumino-silicate which was capable of absorbing ammonium or potassium ions by exchange with sodium.

It is now known that the exchange properties of soil are in part due to organic substances, e.g., the humic acids, and in part to the clay minerals. In general, the latter are crystalline and very finely divided, but owing to their large surface and laminar structure, water can permeate the crystal layers. This porosity permits the entry or removal of cations in solution. These minerals may be regarded as salts consisting of undisturbed complex anions and exchangeable cations. Many other minerals possessing similar structural features exhibit cation-exchange.

At the beginning of this century, the principle of cation-exchange was utilised by Gans to soften water. In this process, calcium and magnesium ions were removed from hard water by exchange with sodium ions, supplied by synthetic aluminosilicates — Permutits. The success of this process led to the search for improved exchange materials. Greater stability to acids, permitting exchange between cations in solution and the hydrogen or acid form of the exchanger, was displayed by products obtained from the partial sulphonation of coal. The permutits and the sulphonated coals are still used in water-softening, but in 1935 a discovery was reported which has provided a wide range of new exchange materials with a vastly extended field of application.

The discovery by Adams and Holmes that certain synthetic resins possessed ion-exchange properties was the result of collaboration at the Chemical Research Laboratory between two groups working on apparently unrelated topics. In connection with a general study of water-pollution, a search was being made for a substance likely to remove iron from water.

It was thought that an insoluble derivative of gallic acid might be suitable and by analogy with the phenolformaldehyde resins, which were being studied elsewhere in the Laboratory, gallic acid was condensed with formaldehyde. The product was insoluble in water and acid, and removed iron completely from dilute ferric chloride solutions.

The successful exchange of cations by resins containing acidic groups suggested that basic resins might be effective for the absorption of acids and exchange of anions. Such resins were prepared by condensing aniline or *m*-phenylene diamine with formaldehyde.

Water De-ionisation

This work was of fundamental importance for two reasons. In the first place, the phenomenon was no longer restricted to the exchange of cations; it became "ion-exchange". This fact made it possible to remove both cations and anions from water, by-passing the raw water first over an acidic resin in the hydrogen form to absorb cations and then over a basic resin to remove the acids formed in the first step. "Water-softening" became "water-de-ionisation." Secondly, ion-exchange properties became associated with synthetic high polymers. Knowledge accumulated in the broad field of high polymer chemistry has enabled ion-exchange materials to be made possessing improved properties and of well-defined constitution.

The manufacture of ion-exchange resins is not a large industry, but within 10 years of the publication of the paper by Adams and Holmes, the production in Germany alone reached the level of 1000 tons a year.

The progress of this industry has been reviewed by K. W. Pepper, PhD. (Lond.), of the Chemical Research Laboratory. Discussing the chemical constitution of ion-exchange resins, Pepper refers to a monofunctional, strongly acidic resin developed in the United States during the war. Styrene and a small proportion of divinyl benzene are copolymerised in an aqueous suspension. The spherical particles of copolymer are then sulphonated directly with concentrated sulphuric acid, yielding sulphonated cross-linked polystyrene.

This material possesses excellent chemical stability, either in the free acid or as a salt. Of great importance, also, is the ease with which the extent of cross-linking can be varied, simply by varying the proportion of divinylbenzene in the monomer mix.

A monofunctional, weakly acidic resin has been prepared by copolymerisation of methacrylic acid with divinyl benzene, yielding cross-linked polymethacrylic acid. Under alkaline conditions, this material has a high total capacity (10 mg.-equivs. per dry g.) due to the high concentration of carboxyl groups.

The earlier anion-exchange resins, prepared by condensing *m*-phenylenediamine with formaldehyde, contain a variety of weakly basic groups. Some increase in basicity has been obtained by incorporating aliphatic amines in a phenol-formaldehyde resin. Very recently, strongly basic anion-exchange resins have become available; they are believed to contain quaternary nitrogen groups. The chemical stability of the anion-exchange resins is generally less satisfactory than that of the best acidic resins.

Acidic Conditions

Studies of anion-exchange equilibria have been restricted by the fact that, until very recently, the only available resins were weakly basic in nature. Ionisation of such materials is negligible in alkaline or neutral solutions and investigations were therefore confined to acidic conditions. It was not possible to decide whether the mechanism was one of "acid-absorption" or "anion-exchange". Exchange of anions is, however, unequivocally observed at neutrality with strongly basic resins.

Exchange by equivalents obtains, provided the equivalent weight, appropriate to the conditions of experiment, is taken. Thus phosphates exchange as $H_2PO_4^-$ at low *p*H and as mixtures of $H_2PO_4^-$ at neutrality. Regeneration of the strongly basic resins from the salt form to the free base requires a large excess of alkali, which indicates that the hydroxyl anion has a low affinity for these resins.

Much work remains to be done on the kinetics of ion-exchange. Exchange proceeds rapidly with the strongly acidic or strongly basic materials. For example, sulphonated cross-linked polystyrene of particle-diameter 0.1 to 0.2 mm., can be readily titrated electrometrically with alkali, the *p*H readings being steady within a few minutes of the addition of alkali.

The rate of exchange increases with decrease in particle size under all conditions. This fact suggests that the rate-controlling step is not the chemical exchange process itself but some diffusion effect.

Film Diffusion

The rate of exchange with sodium ions and certain resins may be controlled by "film-diffusion" or "particle-diffusion", depending on the conditions. With larger cations, especially organic cations such as quarternary bases, the rate of exchange is normally controlled by particle-diffusion. To add to the complexity of the problem, it is now known that the extent of cross-linking or "molecular porosity" of the resin affects the rate of exchange.

At present the only large-scale application of ion-exchange is in water-treatment, which includes water-softening and water-de-ionisation. Ion-exchange provides the cheapest industrial process for preparing electrolyte-free water, provided the solids content of the raw water is not unduly high (less than 500-700 p.p.m.). In water-softening, hard water is passed over a cation-exchange resin in the sodium form. Organic cation-exchange resins are replacing siliceous materials in water-softening because of their higher capacity and because they do not impart silica to the water. A further advantage of the organic materials is their greater stability to acids, which enables a "hydrogen-cycle" to be employed. The chief use of the hydrogen-cycle is water-de-ionisation, which requires in addition a second step, the removal of acids on a basic resin.

In the first stage, sulphates and chlorides are converted to the corresponding acids; bicarbonates give carbonic acid which can be removed by aeration. Regeneration of the cation-exchange resin is effected with sulphuric acid, sodium hydroxide or sodium carbonate being employed for the anion-exchanger.

The efficiency of the process as a whole largely depends on the extent to which cations are removed in the first step. This is influenced by the relative proportion of bicarbonate ion to sulphate or chloride

ions in the raw water. Carbonic acid, produced from bicarbonates, is a weak acid and only partially ionised, hence the forward reaction goes nearly to completion.

In contrast, the strong acids obtained from sulphates or chlorides, being fully ionised, oppose the forward reaction. It may be necessary to repeat both steps in a four-bed process in order to prepare good quality water. On the industrial scale, the ionic content of water can be reduced from 250 p.p.m. to 2-3 p.p.m. at the rate of hundreds of gallons per minute.

Mixed Bed De-ionisation

More complete removal of ions results from the use of a strongly acidic resin mixed with a strongly basic resin in a single bed. By this means, the repeated plate-effect is obtained and "mixed bed de-ionisation" provides an excellent process for preparing high quality water. In the Chemical Research Laboratory, 50 litres of water (specific conductivity, 1×10^6 ohms or better) have been obtained from tap-water using a bed of mixed resins, 11 in. high and 2 in. in diameter, containing 100 g. cation-exchange resin and 200 g. anion-exchange resin. Before regeneration, it is necessary to separate the two resins by flotation in brine.

Removal of salt from sea-water by ion-exchange to give drinking-water is theoretically possible. The scheme is of no practical importance, however, because the volume of water obtained is only slightly greater than the required volume of resins. The salinity of sea-water is roughly 3 per cent or 30,000 p.p.m. A siliceous exchanger in the form of its silver salt, together with silver oxide, was, however, employed for this purpose during the war.

Use in Sugar-Refining

The processes used in the de-ionisation of water have been applied to sugar-refining. Sugar solutions, obtained by extracting sugar-cane or sugar-beet with water, contain organic and inorganic impurities, the removal of which increases the yield and quality of sugar and decreases the molasses requirement. The following steps have been employed in full-scale trials; removal of cations on an acidic resin, adsorption of organic impurities on activated carbon, and removal of acids on a basic resin.

Several schemes have been proposed for the recovery of metals by ion-exchange. During the war I.G. Farbenindustrie (Dormagen) employed a cation-exchange resin to recover copper from cuprammonium waste liquors; full-scale plant for the recovery of silver from photographic wastes was also constructed in Germany.

Possibly the most spectacular application of ion-exchange chromatography has been the complete separation of the rare earths and their preparation on the gram scale by American workers under the U.S. Atomic Energy Commission.

The method developed was a modification of the "elution" technique used widely in adsorption chromatography. In this a mixture of cations is absorbed at the top of a column of acidic resin. The cations are then moved down the column by washing or "eluting" with acid, those possessing a low affinity for the resin moving more rapidly. The affinities of the rare earth cations are very similar and simple elution was ineffective as a means of separation. Success was achieved by elution with an acid (e.g., citric acid), which forms a weakly dissociated complex with the rare earth cations. Fortunately, the rare earths which form the most stable citrate complexes also possess low affinity for the resin, so that the very small differences in affinity are enhanced.

Separation of Amino-acids

Ion-exchange chromatography has proved a most effective method for separating the complex mixtures of amino-acids obtained by hydrolysis of proteins. Pepper also mentions the extraction of alkaloids, the preparation of colloidal solutions, and the use of cation-exchange resins in the hydrogen form as catalysts.

Ion-exchange chromatography is established as a valuable technique in chemical and biochemical research. While large-scale industrial application is still virtually confined to water-treatment, there are good grounds for the view that further applications may be expected as a result of the recent development of improved materials and increased knowledge of their fundamental properties.

Metal Price Changes

THE Ministry of Supply has announced that, as from September 2, the price of good soft pig lead has been increased by £8, from £112 to £120 per ton delivered.

The price of tungsten ore was increased by 5s. on September 4, to between 195s. and 205s., nominal, a unit.

Tin prices fell by over £30 a ton on September 4. At the closing session business was done at the level of £729 per ton, for delivery in three months.

The price of quicksilver rose to between £20 15s. and £21 15s. a flask, on September 4.

CHEMICAL SALVAGE

Profitable Applications in Many Industries

by I. BERKOVITCH, M.Sc.(Tech)., A.R.I.C.

ROUGHLY a century ago legal action had to be taken to prevent manufacturers from discharging hydrochloric acid into the air. Today it would need much more than this to prevent them recovering it as a saleable by-product. To that extent therefore we have enormously progressed in our attitude towards our natural resources. This example also shows how relative a concept is chemical salvage. Today's idea for saving a material which has hitherto run to waste, or for transforming it into a commodity of higher value, is undoubtedly salvage in the first instance; but the process soon becomes a normal and accepted part of industrial production.

A further striking instance arises in the petroleum chemicals industry. Today the chief source of hydrocarbons for chemical synthesis is the gas produced in petroleum refineries where "cracking" is carried out. Some 20 years ago these were considered usable only as fuel and, where no convenient market existed, the surplus was burnt off at a flare pipe. Yet today a major synthetic chemical industry is based on these former waste gases.

The rate of exploitation of all the world's resources of materials has increased at a rapidly increasing rate during many generations and it has now reached a stage where it must cause us all active concern. Thus, on the world scale there is the most urgent need for economising in the use of raw materials, preventing waste and upgrading waste so that it becomes usable. Very largely this tends to be a problem for the chemists working closely with chemical engineers, biochemists and economists.

Salvage from Waste

Scope for chemical salvage, however, arises in the individual factory which is discharging a waste product. Here very often a chemical investigation of the process as a whole results in salvaging further saleable material from the waste or even in eliminating the necessity to discharge waste. On the national scale one finds interest in salvage may develop due to the fact that a country is experiencing shortages of particular elements or of more complex materials. Attention is then directed to economising in the use of these materials, substituting for them or salvaging them where they have to be used and salvage is possible.

The shortage may be due to absence or poorness of natural deposits, or to shortage of foreign currency—notably dollars—or even to political opposition to certain purchases. In some areas, usually tropical, conservation of water is a prime necessity. These are very often what one may call "local" shortages. On a world scale, however, and irrespective of local or financial difficulties, there is a serious threat of world shortage of many resources.

Dangerous Shortages

The extent of such shortages cannot be assessed purely by current production and consumption figures, nor by price trends. Thus, before July of this year many minerals which are approaching exhaustion had tended to fall a little in price over the previous 18 months due to a tightening market. Tin, last year, showed a surplus of production over commercial consumption of about 40,000 tons, which is about a third of actual world consumption.[1] Yet reserves of this element are in danger of absolute exhaustion.

Estimates of mineral resources are continually varying and any one surveyor of this problem rarely agrees with his colleagues. Furthermore, prospecting goes on continually and new reserves of many materials are reported from time to time. Thus, solemn warnings over the past 20 years concerning imminent oil shortages have been made to seem ridiculous by the discovery of vast new fields in the Middle East. Great areas of the earth's surface remain unprospected, and it is little wonder that scant attention is paid by the public to the prophets of woe.

Among the optimists has been Sir Henry Tizard, who recently pointed out[2] that the total volume of minerals consumed is very small compared with the accessible volume of the earth. The total area of the earth's land surface is about 60 million square miles. If one considers one mile in depth as accessible to ordinary mining, the volume available would be 60 million cubic miles. From this vast volume there has been so far extracted about 20 cubic miles of coal, half a cubic mile of iron ore and half a cubic mile of other metals in the whole of man's plundering of this planet.

This type of analysis ignores many

questions. Deposits are not useful unless they contain some critical concentration of the material being sought. Millions of tons of, say, an element, widely dispersed may be less valuable to man than a few thousands of tons in appreciable concentration. Even when a mineral is in useful concentration it may not be workable for other reasons.

Coal may be in seams which are too thin or interbanded with too much dirt. Nevertheless, Tizard has fulfilled a useful purpose in pointing out these relative proportions. It would be very odd, he suggested, if in that large volume there were not still many cubic miles left of acessible minerals. In the case of coal, man probably needs enough to tide him over until atomic energy is the source of fuel, heat and power, and then a supply to provide him only with a coking reserve. Meanwhile, Tizard recognised that the possibility of a shortage of certain essential minerals within a few decades must be faced.

Substitutes for Metals

A large number of workers have pointed out that this is notably true of the elements copper, tin, lead and mercury, which are in danger of early absolute exhaustion.[2] Here there must clearly be an immediate search for substitutes as well as efforts at conservation and re-utilisation. It is obvious from the varying rarity and modes of occurrence of elements that, in terms of social needs, it is not necessary to consider the salvage of all elements but only of particular ones.

Some elements are common and found in virtually unlimited deposits of high concentration. These include calcium and silicon in the earth, sodium and chlorine in sea-water, nitrogen and oxygen in the atmosphere. These need not be considered. A further group are abundant elements which are found in high concentration in relatively limited deposits. This group includes iron, aluminium, magnesium, phosphorus and sulphur. Here the danger arises from the need to go to ever poorer sources with a rise in cost of extraction.

Assessed in this way, the six elements which prove to be most important are carbon, sulphur, phosphorus, iron, tin and lead. Of these, carbon is unique in that its importance is mainly as a source of energy. Thus, the development of industrial atomic energy might reduce the importance of carbon in this list. In any case, the problem is one concerned with greater efficiency in use, rather than chemical salvage. The pooling of heat and power supplies between adjacent undertakings or even whole groups of undertakings would very greatly increase thermal efficiency in industry and help conserve carbon.

Some data are available on the extent of wastage of sulphur, but in general estimates of material which might be recovered—either as elements or compounds—are lacking. Sulphur contained in the annual output of British coal amounts to about 3 million tons, but only about 100,000 tons are recovered. In respect of paper, the Waste Paper Recovery Association makes analyses of the tonnage conserved in this country and the amount collected for salvage, but the discrepancy here is due to failure to collect the used paper and is not a chemical problem.

Under the auspices of the Board of Trade, there exists a National Industrial Salvage and Recovery Council, which has been unable to give estimates of the scope of possibilities in Britain. Data appear to be available only where recovery is currently being practised. For instance, Bradford Sewage Committee reports that from that city's very specialised effluent (from wool-cleaning) they recovered and sold grease to the value of £288,158 and fertiliser worth £22,158 last year alone. Over the past 42 years Bradford has received more than £3½ million for these products.

On the other hand, the sulphite mills of the world, treating timber to convert it into paper, have been estimated to run to waste half-a-million tons of sugar and 1¼ million tons of lignin annually. The mixed pentoses and hexoses of which these sugars consist are capable of producing food yeast. By the end of 1944 the Germans were producing 16,000 tons per annum of food yeast in 12 factories, using wood sugars in sulphite waste liquor as substrates in many of the cases. Hydrolysed wood was used in the others. In Sweden the pink fat yeast *Rhodotorula gracilis* produces from sugars a fat resembling palm oil, with quite high efficiency.

Preventable Waste

In most industries, a great deal of preventable waste still goes on and, like other sicknesses, this one needs immediate first-aid, then medium-term and long-term courses of treatment. This article is not intended to consider the question of looking for fresh sources or the finding of substitutes, but to suggest examples and possibilities of working up waste material, conserving and recovering the scarce, and the refining of crude materials to give more valuable products. All this is essentially short-range work.

Among the materials which are stated to have been recovered from industrial effluents in pre-war Germany[4] are oils, fats, animal feeding stuffs and digestible albumen. Of course, the special circumstances of pre-war Germany must be taken into account and these methods might not be economic under present-day conditions, although they merit careful consideration. A pertinent point is that many of the salvage schemes in pre-war and war-time Germany and in war-time Britain were economic only because voluntary labour was used in its collection. This cannot, of course, be made the basis of ordinary practice. The processes to be described show good possibilities of use on an ordinary industrial basis.

Treatment of discharge water from industrial processes often gives useful results. In all industrialised countries, stringent laws limit the amount of impurity permitted in effluents. In the effort to turn a necessary expense into a good investment, many industries have carried out or sponsored large chemical and biochemical investigations. The two main ways of turning legal necessity into financial virtues as far as water treatment is concerned, are to make the use of water cyclic or to recover saleable by-products. In some particularly happy conditions both features may be present. Since industrial water represents an appreciable expense, the re-use of waste water is a valuable chemical salvage activity.

Prominent in this work in Britain is the Water Pollution Research Laboratory, which has developed several such processes.[7] What has been described as the most spectacular example of re-use of liquors is the system developed for the beet sugar industry. Process water from the screens and presses of a sugar factory contain plant materials and particles of soil in suspension, as well as sugar and other constituents in solution.

Re-use of Process Water

At British factories the process water is now re-used. The waste water is screened and passed through a small settling tank. It is then pumped back and mixed with a proportion of fresh water and the mixed waters re-used.[8] In factories at which screening is efficient the plant can be operated throughout a sugar "campaign" without discharging process water. In general, the re-use of process water appears to have no adverse effect on the yield of saleable products.

Similarly, in the flax industry a cyclic process has been developed.[7] In order to separate the fibres from the stem of the flax plant, the straw is first retted to loosen them, before mechanical treatment. Bundles of flax are submerged in water until eventually the softer tissues of the stems are attacked and partially decomposed by the activity of bacteria.

The previous process, developed on the Continent, was based on the use of anaerobic bacteria, yielding a mixture of foul-smelling waste waters with a *p*H between 4.5 and 5.5. Typical samples were about six times as strong as domestic sewage. An aerobic process was developed in Britain which gives a more manageable effluent and, while the latter is not sufficiently pure for discharge to a stream, it can be returned continuously to the retting tank without seriously interfering with the process of retting.

At the end of a two- to three-day ret with continuous aeration, liquor is returned by gravity from the retting tank for the next ret. From this process there is no discharge of waste waters during the retting season. At the end of the season the liquor in the tanks is disposed of by spraying it over as large an area of land as possible.

Electrolytic Recovery

Processes in which a by-product is recovered may or may not be cyclic in character. In the pickling of metals, waste liquors may comprise spent pickle liquor and waste washing waters. Copper is usually pickled in sulphuric acid and the discharge of excessive amounts of the waste liquors from this process seriously inhibits biological activity applied in sewage purification. Fortunately, they are considered the easiest effluents to treat successfully. Electrolysis in the pickling vat itself, or in a central plant to which the liquor is pumped continuously, recovers the copper and regenerates the sulphuric acid.[7] Applied with great success at a number of copper mills in Great Britain, it gives the further advantages of permitting a high and steady rate of pickling to be maintained.

(To be concluded)

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THE DEVELOPMENT OF ULTRASONICS

Basic Principles and Some Promising Uses

by B. E. NOLTINGK, Ph.D., A.Inst.P.*

ULTRASONICS is defined as the science of vibrations having a frequency higher than can be heard by the human ear. Various experiments have been made in this field for 20 or 30 years, but, at the present time, wider possibilities are opening up, largely as a result of improvements in corresponding electronic techniques, which make it possible to generate ultrasonics at high intensities and more conveniently.

Sound can be pictured either as a pressure wave in which alternate high and low pressures follow each other, or as a longitudinal movement of the elements of volume in the medium traversed. The more familiar airborne sound has a frequency range covering 30 c/s up to 15 kc/s. The human threshold is in the region of 3×10^{-15} W/cm^2 while even 20 ft. away from a noisy motorcycle the intensity is only of the order of 10^{-5} W/cm^2. With ultrasonic generators that are commonly available, this figure can be exceeded by a factor of a million and more.

Transmission of Energy

Sound waves, are not, of course, passed through a vacuum; they can pass through a liquid or solid, but if an attempt is made to transmit such waves through a gas to either a solid or a liquid only a very minute fraction of the original energy is propagated forwards. This is because the transmission of energy is associated both with movement and with force—both with strain and stress and hence a considerable difference will exist between highly compressible air and nearly incompressible water. In the one instance there is a relatively large strain and small stress and in the other it is the reverse.

The position is analogous in some respects to the transmission of electrical energy when there are many amps. and few volts, or *vice versa*. In fact, the term " impedance " is used in both connections; acoustically speaking, impedance is defined as the product of density and the velocity of sound in the medium. When a sound wave reaches the interface between two media, if there is a mismatch a large force may be applied, but not over a sufficient length to communicate appreciable energy. The reverse may occur, when the movement is adequate but the force too small. Thus the energy cannot be passed from one medium to the other, neither can it be annihilated, and since it has arrived at the boundary, it must be reflected backwards.

This aspect may appear to have been unduly emphasised, but it has important practical consequences in the application of ultrasonics, because it means that a fairly sharp distinction can be drawn, according to whether the energy is to be generated and used in gases, or in liquids and solids. The generators for the two uses are normally quite different.

To generate vibrations in a gas it is, of course, possible to start with a moving solid body, but the solid body will need to move a considerable distance in order to pass on high power to the medium. Hence there is some advantage in first generating the vibrations directly in the gas. This can be done by means of a siren, which is probably the most frequently used type of generator. Several applications have been reported for ultrasonics in gases.

Coagulation of Aerosols

Coagulation of aerosols has been attempted on a large scale, though the mode of action of this is not fully understood. Part of the explanation is that particles, suspended in a sound field in a fluid, participate in the vibrational movement of the fluid to an extent that depends upon their size. There is, therefore, an increased probability of collision between particles of different diameters, and the effect is cumulative, ultimately leading to widespread coagulation.

Broadly speaking, this technique is successful when applied to confined spaces such as smoke stacks. It is not an economical possibility in the open air, where an increased effect due to standing waves cannot occur. At 20 kc/s the absorption of air is such that a beam will drop to half its intensity in about 50 yards.

Turning to the generation of ultrasonics in liquids and solids, the subject can be again divided into low power applications when signalling, for gaining information and high power applications for treatment

* Of Mullard Electronic Research Laboratories, in a paper presented at the Engineering Centre, Glasgow, May 11, 1950, of which this is an abstract.

purposes, for producing permanent effects. The obvious way to generate ultrasonics in a liquid is by making a solid body vibrate and the effect can be increased considerably by making use of the phenomenon of resonance.

Comparatively small bodies are needed to generate high frequencies because, broadly speaking, resonant frequency varies inversely with the size of the body. The problem of driving the small solid then arises: it is impossible to connect it to any conventional mechanical apparatus without unduly increasing the overall size. This compels the use of phenomena by which energy can be converted from an electrical to a mechanical form within the vibrating body itself.

The best known of such phenomena is that of piezo-electricity, in which certain crystals, such as quartz, are altered in shape by application of an electric potential across them. Many ultrasonic generators have been built using quartz elements.

A new material recently suggested for this purpose is barium titanate, a ceramic which shows properties akin to piezo electricity after it has been electrostatically polarised. It is too early to assess the relative merits of the old and newer materials. For lower frequencies, magnetostriction is used, *viz.*, the fact that certain metals change shape under a magnetic field.

The electrical apparatus merely provides electrical energy at the appropriate frequency to drive the "transducer" element, which will convert it into acoustic energy. The generator must be suitably matched in impedance. The impedance of piezo-electric devices, however, falls off rapidly as their resonant frequency is increased. It is thus much simpler to match a 2 Mc/s crystal than one for 1/4 Mc/s.

Echo Sounding

Underwater marine devices probably represent the largest single application of ultrasonics. Echo sounding and the location of fish shoals are also commonly accepted techniques, and depend upon picking up an ultrasonic signal from the foreign body concerned.

A sound is attenuated in air several hundred times more rapidly than in water, so it is possible to "see" by means of ultrasonics a very long distance through water. Similarly, in steel, X-rays can penetrate only a few inches, but ultrasonics can pass quite readily through several feet, and in examining steel for flaws the same principle is used as when examining sea water for fish.

In optics, the information derived from an incoming signal can be a composite picture for which rectilinear propagation is necessary—or a measure of the refractive index of the medium examined. Similarly, in acoustics there are analogues of these processes, and the velocity or absorption of sound in the medium can be measured. The former principle has been put to practical use in an instrument for measuring the quality of concrete, which is found to correlate well with the velocity of sound in it. The second principle has been incorporated in a device for determining the amount of solid suspended in a liquid.

Heating Effect

To high power applications of ultrasonics there are no optical analogues. The reasons for the various effects produced differ from case to case. There is, for instance, a considerable heating effect associated with the absorption of vibrational energy in any medium. There are also very large accelerations following from the high frequency movements of the elements of volume. For instance, the water particles excited in a tank by a commercial generator operating at 1 Mc/s can accelerate some 400,000 times faster than if they were falling freely under gravity. Both these effects sometimes produce permanent changes in the material being treated.

Another phenomenon responsible for many of the effects observed is that of cavitation. This may be pictured simply as minute gas nuclei expanding and contracting under the influence of the alternating pressure. The hydro-dynamics of the problem is such that the collapse is much more violent than the growth and it appears that very high pressures and velocities and, perhaps, very high temperatures and electrical discharges all occur.

While the details are still obscure, some experiments have been made with hydraulic apparatus in which the broad outlines of the picture have been confirmed. There is considerable evidence that in ultrasonics the intensity of cavitation is likely to increase as the frequency is reduced. A large number of minute bubbles can be pictured as collapsing on any surface which is immersed in a liquid subjected to such vibrations, and this results in a progressive erosion of the surface unless it is of a very resistant material.

Most metallurgical applications of ultrasonics probably depend on cavitation, since they are effects of breaking up one mater-

ial in another. A great refinement of the grain has been brought about by submitting melts to the action of intense vibrations during solidification. Another application which holds promise of great usefulness is in the soldering of aluminium. The oxide skin can be torn off under the action of ultrasonics, so allowing molten solder to alloy with the metal underneath.

The emulsifying of one liquid into another, which is frequently observed, also has its origin in cavitation. This may have commercial attractions when the conventional ways of emulsifying cannot be used.

Dispersion of solid particles in liquids may also be brought about, and there is some evidence that carbon is readily dispersed, a fact which suggests that specialised laundering techniques may become possible. Instead of dispersion a coagulation occasionally results, similar to that found with aerosols.

Several chemical effects reported such as depolymerisation or the break-up of benzine. The general tendency is towards oxidation. It has been suggested that the only primary effect of ultrasonics is that hydrogen peroxide is produced from water vapour during cavitation. Most chemical reactions of that kind occur only very slowly and are therefore less attractive commercially, unless only traces of the new products are required. This field is in general, still at the fundamental research stage.

Many biological effects have been closely studied. Bacteria are found to be destroyed roughly logarithmically with time. This is probably another cavitation effect. It may be that the bacterial membrane is ruptured by the pressure difference across it. The destruction is not instantaneous and is dependent on the medium in which the organisms are suspended. Commercial applications are likely to be specialised, such as the production of antigens or the sterilisation of substances for which conventional methods are not available.

In higher forms of life there are also effects possibly due to the heating of tissue or to cavitation in the body cells. Small fish, for instance, can be killed by irradiation for a few seconds. A sharp pain can also be brought about from high power ultrasonics in the human body but definite evidence has been found of the beneficial therapeutic value of lower intensities—perhaps from a massaging effect, leading to an increased flow of blood through the capillaries. Little success has been found in the treatment of cancer or of lung complaints, but sciatica, lumbago and abscesses are all said to respond well to ultrasonic treatment. It seems probable that within a few years this will become a recognised and widely used accessory to other forms of treatment.

U.S. Sulphur Resources—Concern Over Dwindling Reserves

THE increased interest in American national defence has lent new urgency to the inquiry into American sulphur resources, on account of the widespread uses of sulphur and sulphuric acid in explosives and rubber, etc. The principal sources of natural sulphur at present are Texas and Louisiana, which supply 79 per cent and nearly 21 per cent of the total output respectively. Since a U.S. Bureau of Mines estimate in 1944 that these deposits provided a reserve of 80 million tons, about 25 million tons have been extracted, leaving a known reserve of 55 million tons. At the present rate of consumption it is estimated that this reserve might last only 11 years. In face of eventual depletion, therefore, the sulphur industry in America is conducting a search for untapped deposits of sulphur, both in America and abroad. While this is being done, secondary sources of supply are being investigated, the possibilities of fuller yields of sulphur from pyrites and from oil refinery gases will be achieved. A further supply of sulphur and sulphuric acid is obtained from smelter gases. It is the belief of the American sulphur industry that, by developing these and similar methods, a reserve stock of 120 million tons could be built up.

Laminated Glass Fibre Tubes

Development of a new glass-fibre tube and pipe material, designed as a replacement for steel and other critical war metals in many commercial applications is announced by United States Plywood Corporation, New York. The new product, Glasweld, is said to have the strength of steel and is rust and corrosion proof. It is now available in the oil and chemical processing industry. It is a laminated material in which glass fibres in the form of cloth or tape are bonded with resins to develop a tube impervious to extreme heat, chemical action and shock. It has marked acid resistance.

Technical Publications

REFLECTING broadened interest in the international status of minerals, a new edition of Minerals Yearbook, authoritative source of information on domestic and foreign mineral commodities compiled annually by the Bureau of Mines, has been increased to 1626 pages. The new issue's extensive economic and statistical data review the production, distribution and consumption of all mineral commodities, including fuels. Bound copies of the yearbook ($4.25) can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. All chapters are also available as reprints.

* * *

DENSITOMETRIC measurements by means of a logarithmic potentiometer are described by J. A. Hall, A.R.C.S., B.Sc., D.I.C. (National Physical Laboratory), in "Technique" (Vol. 4, No. 3) published by Muirhead and Co., Ltd., Beckenham, Kent. Another article describes developments in the application of tuning forks to scientific purposes.

* * *

TANNING, its early history, the colouring of leather, and preservation of skins, form the subject of the illustrated article in the August issue (No. 81) of the "Ciba Review," published by Ciba, Ltd., Basle, Switzerland. The next number in October will be devoted to water, its occurrence and nature, treatment for trade and industrial uses, purification of waste waters, and municipal supplies past and present.

* * *

THE importance of securing fixed quantities of impurities in iron samples required for specific metallurgical tests has received attention by J. D. Fast (Eindhoven), whose contribution in the current Philips Research Reports (4, 5) describes in detail a high-frequency melting apparatus for preparing such special alloys. The method is based on the preparation in the first place of carbonyl iron samples of very high purity by high frequency melting *in vacuo* or under pure argon.

* * *

WATER pollution abstracts published monthly by the DSIR give a summary of recent literature on the subject. The latest abstracts available are December 1949 (Vol. 22, No. 12, Nos. 1422-1530) and January 1950 (Vol. 23, No. 1, Nos. 1-120).

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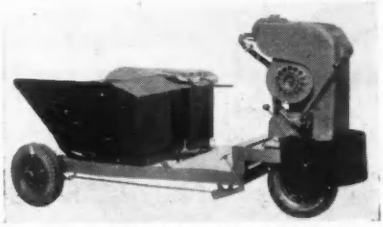


[By courtesy of Wessex Industries (Poole), Ltd.

A 3 h.p. tipping truck, manually controlled, the body of which can be interchanged with a platform assembly

USES and methods of applying a low-temperature-melting alloy which expands slightly on solidification are described in a fully illustrated manual obtainable from Mining and Chemical Products, Ltd., London. Known as Cerromatrix, the alloy is composed of bismuth, lead, tin and antimony, and has a wide range of industrial applications.

* * *

AS a means of accurately controlling small amounts of reagents fed to pilot plant flotation machines an electrolytic feeder has been developed in the New Jersey Zinc Company laboratories. The apparatus is described in "Deco Trefoil" (Vol. 14, No. 4), journal of the Denver Equipment Co., Denver, Colorado, U.S.A.

Specialist Library Services

BRISTOL University will be host from Friday, September 22 to Monday, September 25, to the 25th annual conference of Aslib, whose president, Dr. Percy Dunsheath, last year accused the Government of failing to recognise the value to the country of an efficient library in the field of science and technology, and advocated the establishment of such a library five times as large as the existing Patent Office Library in London.

Aslib, which is this year primarily concerned with the organisation of specialist scientific and technical knowledge in the service of British industry, is conducting a vigorous campaign to ensure that the fullest possible use is made of all published technical information.

The Chemist's Bookshelf

CHEMICAL INDEX OF MINERALS. M. H. Hey. 1950, London: British Museum. Pp. xx + 609. 30s.

Many books exist for the purpose of identifying minerals by their physical properties and by blowpipe tests, but until now there has been no complete work dealing with minerals arranged according to their chemical composition. For this reason the index of mineral species, which was originally begun as a card system in 1942 to meet a practical need in the Department of Mineralogy and is now published by the British Museum, should be most welcome.

The book is divided into two parts, the chemical index (286 pages) and the alphabetical index (318 pages). The general principle has been to subdivide the chemical section by anions and to group similar combinations of anions together. There is, for example, a section "Borates" and, next to it, "Borates with other Anions." Likewise, silicate minerals fall into four categories: "Silicates of Aluminium," "Silicates not containing Aluminium," "Silicates of Aluminium and other Metals (Alumino-silicates)," and "Silicates and Alumino-silicates with other Anions."

The alphabetical index is arranged in three columns. In the first column appear the names of the minerals, heavy type being used to distinguish accepted names from synonyms, colour and "trivial" varieties, pseudomorphs and group names, which are printed in ordinary type. The second column gives a literature reference and the third column contains an annotation upon the name of the mineral. In the case of "trivial" varieties for example, the name of the parent species appears, introduced by "Var. of." For accepted names of species and chemically distinct varieties the third column contains the reference number used in the chemical index, the name of the author and date of introduction of the name, and, where the original spelling differs from that commonly accepted it is appended in parenthesis.

The work involved in this index must have been prodigious. The author has been to considerable trouble to apportion his classification by study of the literature and careful criticism of chemical analyses and formulæ in the light of recent X-ray studies.

To chemists, geologists, and all those who study minerals, this work is highly commended. No library is complete without it.—P.M.

ERNAEHRUNGSFORSCHUNG UND ZUKUENFTIGE LEBENSMITTELCHEMIE. Kurt Täufel. Berlin: Akademie-Verlag. 1950. Pp. 30. Dm.3.50.

Food chemistry today tends towards the view that foodstuffs in general are mostly very complicated mixtures whose composition is only partly known. Accurate analyses meet with great difficulties and therefore it is considered sufficient to summarise similar components such as nitrogenous substances, ether-extract, acid-titration, etc. The principal consideration, however, remains the nutrition value. One gets nearer the essence of a foodstuff when looking at it not only as a mixture, but as a biologically organised system. In this perspective, the present publication deals with foodstuffs deliberately as physiological substances, with physiological and non-physiological changes, with model research methods, with the aims of food analysis, the problems of food technology as well as normal and abnormal foodstuffs. These headings lead, so to speak, to functional food chemistry and point the way to future research principles.

Book Received

SYNTHETISCHE METHODEN DER ORGANISCHEN CHEMIE. Volume 4. W. Theilheimer. 1950. Basle: S. Karger, A.G., Verlag. London: Inter-Science Publishers, Ltd.

Erratum

In last week's "Chemist's Bookshelf" the title of "The Chemistry of the Acetylene Compounds. Vol. 2, The Acetylene Acids" should instead have been "The Chemistry of the Acetylenic Compounds. Vol. 2, The Acetylenic Acids".

£80 More for Lactic Casein

As from September 4, the prices of Government stocks of lactic casein have been increased by £80, to between £200 and £215 a metric ton.

OVERSEAS CHEMISTRY AND INDUSTRY

WORLD POTASH SUPPLIES

Important Contributions of France and U.S.A.

WORLD production of potash (K_2O) in 1913 was about 1.2 million, in 1938 3 million and in 1949 4 million tons. Principal contributors to the last total (in 1000 tons) were West Germany 750, France 890, Spain 170, U.S.A. 952, and Russia, E. Germany and Poland (as a very rough estimate) 1400. Germany's share of world production in 1913 was 96.2 per cent, and in 1938 56.8 per cent. Post-war output in West Germany has increased from 285,000 tons in 1946 (excluding the French zone) to 750,000 tons in 1949 including that zone; and in 1950 it is estimated it will reach 900,000 tons. (Carl Liesegang, *Chem. Ind.* Aug. 1950, 405-8.)

With the return of Alsace-Lorraine, France became second (after the U.S.A.) among the principal producers in 1949. The mines are state-controlled as Mines Dominiales, except the Mines de Kali Sainte Therèse. A Franco-German agreement in 1926 settled various matters of division and working. More than half of the 1949 output was used in France and her colonies, and the remainder (410,000 tons K_2O) was exported.

Many new shafts have been sunk in France, and it is planned still further to increase output, to 950,000 tons in 1952, and 1.2 million tons in 1957. Potash salts have also been found in other parts of France, notably in the Landes and Basses Pyrénées areas, especially sylvinite, and a State-controlled company, Soc. des Mines de Potasse et Magnésie, was formed to exploit them. Results so far, however, appear to have been relatively small.

U.S. Production

The remarkable increase of potash production in the U.S.A. is well known. Some deposits in Canada (Saskatchewan) are also known, but the position is somewhat different in the case of Russia and Poland. In the former, substantial deposits have been found in many localities, first in the western Urals in 1916-17, at Solikamsk on the river Ussolka, and other places, both carnalite and sylvinite, to the extent of several milliard tons. Subsequently, through geological and geophysical exploration, deposits were found at other places, e.g., between the lower Volga and Caspian Sea, south of Sarotow near Osinski, between the southern Urals and the Emba, including both sylvinite and sulphate salts.

Some of these were thought to be extensions southward of the Solikamsk deposits, but with higher K_2O content. In Central Asia also, south of the Aral Lake (Buchara) on the borders of Afghanistan, potash salts are said to exist, but little seems to be known of these. Estimates of Russian pre-war (1938) potash output varies from 360,000 to 400,000 tons.

In Poland, the new territory added since the war has largely increased the potash resources of that country, including more particularly those of Galicia, though much is under Russian control. No recent figures are available. Before the war production of potash in Poland was on the up grade and had reached about 108,000 tons in 1938.

Spanish Deposits

In Spain, potash discoveries were made in 1912 in the north-east, near Cardona about 50 miles north-west of Barcelona, including carnallite (10 per cent K_2O) and sylvinite (14-23 per cent K_2O). Reserves were estimated at 500 million tons K_2O.

Production of potash in Spain rose from 2770 tons in 1925 to 131,684 tons in 1934, and, after some decline during the Civil War, reached 153,800 tons in 1947. In 1935 Spain became a partner in the international (Franco-German) agreement with a 15 per cent share in the export trade. Most of the output was exported, despite the demands of Spanish agriculture, and amounted in 1947 to 104,000 tons. The relatively high quality of the deposits and their proximity to the coast should have favoured development, but certain difficulties were encountered, including lack of adequate water supplies. However, it is hoped that this year output will reach 200,000 tons and in 1952 250,000 tons (K_2O), with more than two-thirds for export. A new find was made in 1948 at Igunatal near Santander, probably connected with the Ebro deposits.

The Dead Sea resources in this mineral have been estimated at 40-50 million tons (K_2O). Most of the export hitherto has been to England, but the policy of the Israel government is apparently to alter this and divert the export trade to Africa, the Middle East and the South Pacific.

GROWTH OF POLISH CHEMICAL INDUSTRIES

Progress Towards Self-Sufficiency

THE chemical industry in Poland appears to have made great progress in the past few years and ambitious plans are announced for the future under the six-year plan which begins this year. In 1948 capital investment (including State funds) was raised to Zl. 7.8 milliard, and was still larger in 1949. Pre-war capacity in many sections has been greatly exceeded, especially in heavy chemicals, pharmaceuticals and fertilisers.

New works have been built and older ones modernised. More than 25 modern factories have already been completed, employing about 22,000 people. Plastics, textile chemicals, insecticides, and many other products are sharing in this advance, states a report by Dr. A. Metzner, of Frankfurt-on-Main (*Chem. Ind.*, August, 1950, 408-411).

Soda production, formerly in the hands of Solvay-Werke, reached 190,000 tons of ash and 47,000 tons of caustic soda in 1948, and last year was 228,000 and 57,000 tons respectively. The 1950 monthly output has so far averaged about 10 per cent more.

Insufficient Acid

Sulphuric acid is still in short supply despite serious efforts to attain and pass the pre-war output. The position would be still worse had not the factories of Silesia added a substantial quota to existing supplies. The real cause of the persistent shortage is a lack of raw material, notably zinc ores and pyrites. In 1938 sulphuric acid production was 314,000 tons; in 1948, 221,000 tons; in 1949, 278,000 tons. By 1955 it is planned to increase it to 400,000 tons to cover the anticipated home demand, using as additional raw material the large native resources of gypsum. (Presumably the combined cement/acid process is here referred to, states Dr. Metzner, though nothing is said about cement). The aid of East German chemists may be enlisted in this project.

One of the effects of the shortage of sulphuric acid is that the output of superphosphate in 1949 was only about half the capacity total of nearly 80,000 tons. The average monthly output in 1950 so far is up by about 18 per cent, and at this rate is estimated at 470,000 tons for the whole year. Crude phosphate is mostly obtained from Russia. Almost complete independence of imports has been achieved in potash. Control of the valuable deposits in East Galicia, however, is now in Russian hands.

Fertiliser consumption in Poland is to be heavily increased, and at the end of the six-year plan should be per hectare: 12 kilos N, 15 kilos P_2O_5, and 5-6 kilos K_2O, about five times as much as pre-war. Two new synthetic nitrogen works are under construction and should bring the total nitrogen to 202,000 tons, or, including ammonium sulphate from gas works, 220,000 tons.

Sodium Products

In 1938 salt production in Poland was 566,900 tons, and the relatively newly found deposits around Posen, together with the bituminous coal there, should create a new centre of chemical industry in that district.

In the electrochemical field special attention has been given to the electrolysis of brine and the production of ferrous alloys. Conditions for the economic production of caustic soda by electrolysis in Poland are favourable, both electric power and salt being plentiful and cheap. The question whether the old Siemens-Billiter process will be used or replaced by newer methods has not yet been wholly settled, although it has been decided in any case to install at least one new mercury-electrolysis plant with a daily capacity of 20-30 tons Cl, ensuring also pure caustic for the artificial silk industry.

Before the war Poland imported large quantities of coal tar products, but now, with the help of the additional Silesian coke ovens and tar distilleries, and increasing capacity in other parts of the country, considerable progress is being made towards self-sufficiency. Benzol, toluol, cresol, phenol and naphthalene are already on the export list. Later, these are expected to be used more at home and the export of finer derivatives to increase. Coke production has more than doubled since before the war. In 1949 it was 5.7 million tons. Twenty coke ovens are now in full operation, producing a nearly complete range of by-products.

There is a large demand in Poland for coal-tar types for a correspondingly large and expanding textile industry. Production in 1949 at 3700 tons was nearly double that of 1938, but considerable quantities of dyes and intermediates must still be imported.

IMPROVED GERMAN CHEMICAL TRADE

Satisfaction at Recent Agreement with Britain

INSTEAD of the usual seasonal calm, chemical manufacturers in Western Germany during August experienced a marked improvement in the receipt of orders, especially for products likely to be affected by higher commodity prices in the world market. A revival of buying interest has also been noted on the part of foreign customers, who evidently wish to add to their stocks.

Of recent trade negotiations those with Great Britain were the most important ones from the German point of view. Satisfaction is expressed at the fact that the Western zone is to be treated as a "soft currency country," and it is hoped that exports from this area to other sterling territories, notably South Africa, Australia and India, will benefit from this.

Two other recent trade agreements are likely to prove beneficial for the West German chemical industry. The trade and payments agreement with Brazil provides for shipment of U.S. $13.8 million worth of chemicals, from the zone, including aniline dyes valued at $2.5 million, drugs and pharmaceutical preparations, $2 million, and potassium chloride, $600,000.

The commercial treaty with Italy provides for West German deliveries of dyestuff intermediates worth $300,000, solvents $450,000, textile auxiliary products $150,000, other chemicals $500,000, medicinal specialities $1 million, and pharmaceutical preparations $500,000. Further deliveries include intermediates for the manufacture of pharmaceuticals, $200,000, synthetic dyes, $2 million, synthetic wax $150,000 and chemical machinery $800,000. Italian products supplied in return include tanning materials $730,000, sulphur $500,000, talcum $200,000, bauxite $200,000, and other chemicals $400,000.

Trade with South America

Trade negotiations now in progress with Chile are expected to result in a resumption of Chile saltpetre shipments to Germany.

Home market sales of chemical fertilisers in the 1949/50 agricultural year have been disappointing. The consumption of nitrogenous fertilisers was 9 per cent and that of phosphatic fertilisers 13 per cent below the pre-war level. Compared with 1948/49, only the consumption of potash salts has increased to any noticeable extent. The disappointing home demand is attributed chiefly to high taxation and marketing difficulties for certain kinds of farm produce subject to import competition, but farmers in Western Germany seem to be rather doubtful about the economic value of heavy fertilising in the present uncertain situation.

To offer an attraction to consumers, the nitrogen industry is now granting special price reductions for early acceptance of delivery. The export quota of 50,000 tons of pure nitrogen was fully utilised in the first half of 1950 when Holland, Spain and Egypt were the best foreign markets. In 1950/51 between 120,000 and 150,000 tons of pure nitrogen may be available for export. The West German nitrogen capacity, it is stated, is far from being fully utilised at present, and an increase in home and foreign sales would therefore not meet with any difficulties on the production side.

Potash Production

Figures for the production year which ended in June, 1950, show that the potash industry of the zone exceeded its output target. About 8.15 million tons of potash salts were mined in the 12 potash mines on Federal territory, and the potash fertilisers produced from them had a K_2O content of 786,000 tons. Including crude salts sold directly to agriculture, the total production in 1949/50 may be put at 840,000 tons (K_2O), compared with 630,000 tons in 1948/49 and 450,000 tons in 1947/48. Exports in 1949/50 increased to 235,000 tons (K_2O) compared with 60,000 tons in 1948/49 and 30,000 tons in 1947/48. The Scandinavian States, the Benelux countries and Great Britain were the principal buyers. Japan had also emerged as an important consumer of German potash salts, and substantial tonnages were shipped to North and South America. In the current fertiliser year—1950/51—shipments abroad have started at a substantially higher rate than last year, despite the falling-off of production in the April-June quarter.

The West German soap industry which has for some time been suffering from an appreciable contraction of consumers' demand has lately been able to clear its surplus stocks. Some producers of popular brands have had to stipulate extended delivery terms. Prices, however, are still under pressure because of heavy competition.

YUGOSLAVIA'S OIL

New Production and Development

YUGOSLAVIA is reported to have succeeded in entering the ranks of Europe's commercial oil producers. Output in 1949 amounted to some 340,000 tons, equal to 100.8 per cent of the planned figure, and to 75.5 per cent of the total of 450,000 tons aimed at for the last year (1951) of the current five-year plan. Output for the current year is confidently expected to reach 410,850 tons.

The importance of what is being achieved is illustrated by the fact that in 1939 output amounted only to 1000 tons produced by the Medjimursko Petrolejstvo Drustvo (in which Swiss capital participated) from the Donja Lendava field, near the frontier with Hungary. This remarkable increase is due principally to the progressive development of the Donja Lendava field. A substantial supplementary supply is likely to come from Northern Croatia. There is very active prospecting there and elsewhere.

The enterprise represented by the Yugoslav progress is emphasised by the facts that there was before the war no home production of drilling or refining equipment, the Germans denuded the country and Russia has failed to honour her undertakings to supply what was needed—25 sets of drilling equipment, of which only five incomplete ones were provided. By the beginning of this year, ten complete sets of drilling equipment had been made within the country as a result of co-operation between a number of firms and, more recently, it was decided to establish a plant for the manufacture of drilling equipment only.

The expectation of equipment and pipes from the U.S.A., financed by part of a current $20 million credit, and of oil drilling equipment from this country, Yugoslavia should be able in future to keep fully occupied the two important refineries at Rijeka (Fiume) with a capacity of 850,000 bbs.p.a., and former Shell plant at Sisak (600,000 bbs.p.a.) which has meanwhile been considerably expanded. The capacity of the new refinery in Sumecani in the Gojlo area (north-east of Ivanic Grad) is not stated.

Oils and Fats Prices Unchanged

The Ministry of Food announces that no change will be made in the prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the four-week period ending September 30.

NEW RAYON PULPS

Likely Alternatives in India

CERTAIN varieties of bamboo, reeds, bagasse and jute fibres yield high grade pulps with high alpha-cellulose content.

A detailed investigation into the preparation and properties of pulps from the raw materials with respect to their suitability for rayon manufacture has been completed in the Cotton Technological Laboratory in Bombay. The recently published results of this investigation indicate that cellulose esters prepared by the action of glacial acetic acid and acetic anhydride on these pulps have also been tested for their suitability in the manufacture of cellulose films.

The products obtained from bamboo reeds and bagasse have an alpha-cellulose content of over 85 per cent and an ash content varying from 0.2 to 0.3 per cent. This meets the requirements of pulps suitable for rayon manufacture.

Bagasse pulp viscose for rayon takes seven days to mature, whereas viscose obtained from other pulps matures in four days. Bagasse pulps are said to require the minimum amount of carbon disulphide (48 to 70 per cent), whereas some others require over 90 per cent of the weight of pulp.

The experimental data published indicates that pulps from these sources, after a preliminary treatment with caustic soda, are suitable for use in the rayon industry. Pilot plant trials will be required to produce definite conclusions.

Next Week's Events

MONDAY, SEPTEMBER 11

UNESCO

Paris: International Meeting of the Associations for the Advancement of Science. Two days.

Shoe and Leather Fair Society

London: Olympia. Shoe and Leather Fair. Until September 15.

WEDNESDAY, SEPTEMBER 13

Royal Photographic Society of Great Britain

London: 16 Princes Gate, S.W.7. 3 p.m. to 6 p.m. The 95th Annual Exhibition of Photography.

THURSDAY, SEPTEMBER 14

Incorporated Plant Engineers

Newcastle-on-Tyne: Royal Turks Head Hotel, Grey Street. 7.30 p.m. "Metallising for Industrial Plant Maintenance" by J. Barrington Stiles.

• OVERSEAS •

Another Big Uranium Claim

What is claimed to be a " massive formation " of uranium ore has been found on the banks of the Ferguson river, near Katherine, 200 miles south of Darwin, in the northern territory of Australia.

U.S. Platinum Price Raised

New prices for platinum in the U.S.A. were quoted on August 31 at $90 per oz. retail, and $87 for bulk amount. With this increase of $13 per oz. it was disclosed that platinum was no longer available to the jewellery trade.

25 Per Cent More Cellophane

A sixth Cellophane casting machine is to be installed at the Shawinigan Falls works of Canadian Industries, Ltd., and will increase production of the transparent cellulose film by approximately 25 per cent. This, with other new equipment and additions to existing buildings, will require approximately $1.5 million. The project is expected to be completed early in 1952. More than three-quarters of the Cellophane produced at Shawinigan Falls is used in the Canadian food industry.

Augusto Righi Centenary

To commemorate the centenary of the birth (August 27, 1850) at Bologna, of Augusto Righi, the Italian physicist and a former member of the Royal Society, the Italian Physical Society is holding a congress there from September 15 to 20. Righi's earliest work was on the change of the electrical resistance of bismuth in a magnetic field, and he applied the phenomenon to the measurement of magnetic fields. Among the many honours conferred upon him was the Hughes Medal of the Royal Society.

New Water Soluble Cellulosic

A new water soluble cellulosic, sodium cellulose sulphate, SCS, was introduced by the Tennessee Eastman Corporation, at the National Chemical Exposition, Chicago, Illinois, which opened this week. Made by treating cellulose fibres with sulphuric acid and certain other reagents, the resulting granular product in a 3 per cent solution in water permits the production of a clear, strong, grease-proof, non-burning film. The new cellulose gum is expected to improve the effectiveness of synthetic detergents by holding soil particles in suspension and to be used in water paints, emulsion paints and textile finishing.

Steel and Sulphur for Chile

Production of steel in Chile has been started by the furnaces of the Cia. de Acero del Pacifico at Huachipato. The construction team will be occupied with work on the construction of a new sulphur plant being erected by Follies Brothers in Chuquicamata.

Aluminium Development in Burma

The annual output of Burmese aluminium works now totals 1975 tons of finished goods, compared with 538 tons before the war. There are 60 aluminium factories in Rangoon, employing 838 workers. Government's industrial grant to aluminium works now amounts to Rs. 1 million.

U.S. Plans to Mine Cobalt

Cobalt, vitally necessary for the fabrication of permanent magnets and special high-temperature steel alloys is to be mined by mid-1951 by Howe Sound Company at its Blackbird mine in Idaho, which has been under development for the past several years. At present the United States produces insignficant amounts of cobalt. The bulk of the world's supply comes from the Belgian Congo (75 per cent) and about 15 per cent is produced by Canada and 5 per cent by Northern Rhodesia. The Blackbird mine is expected to provide some 2 million lb. of metallic cobalt yearly. In 1949 the U.S.A. consumed about 4.7 million lb. of cobalt.

Coal Production and Exports

PROVISIONAL figures of the Ministry of Fuel and Power show that the total saleable output of coal last week, including 207,700 tons of opencast coal, was 4,130.300 tons, against 4,065,300 tons in the previous week. Nearly 67,000 tons were lost through holidays last week, against 165.300 in the pevious week. In the 35 weeks of 1950, production has totalled 143,619,700 tons, or 1,833,200 tons more than in the corresponding period last year. Exports in the week ended August 26 were 168,000 tons, against 182,000 tons in the preceding week. In 34 weeks of 1950, 9,480,000 tons of coal have been exported, 1,400,000 tons more than in the same period last year.

PERSONAL

SIR HAROLD HARTLEY, president of the British Association, was awarded an honorary degree of Doctor of Science at Birmingham University on September 2.

DR. C. H. HAMPSHIRE will retire from the secretaryship of the British Pharmacopœia Commission on October 3 and will be succeeded by MR. T. C. DENSTON, at present deputy secretary. Dr. Hampshire will remain as editor of *The Journal of Pharmacy and Pharmacology* and will continue his work on the International Pharmacopœia for World Health Organisation.

MR. FRANK G. ANDREAE, a director of Quickfit & Quartz, Ltd., has retired after 22 years' service with the company. He joined the board in 1935.

MR. C. L. G. FAIRFIELD has been appointed a director of Mullard Equipment, Ltd., with effect from August 1.

The following are among the appointments in the Colonial Service recently announced: MR. W. E. CALTON (government chemist, Zanzibar) to be government chemist, Tanganyika; MR. A. CAWLEY (mining geologist, Nigeria) to be assistant director of geological surveys, Nigeria; MR. A. H. MILLARD (pharmaceutical chemist, Federation of Malaya) to be chief pharmaceutical chemist, Federation of Malaya.

SIR BEN LOCKSPEISER, secretary of the DSIR, will be the principal guest at the third annual dinner of the Birmingham University Chemical Engineering Society on March 14.

DR. KENNETH C. D. HICKMAN, whose ingenuity and leadership made possible the production of vitamins A and E from raw materials formerly considered unusable, has been awarded a John Price Wetherill Medal by The Franklin Institute, of Pennsylvania. Dr. Hickman was born in London in 1896 and graduated from the Royal College of Science in 1916. He received a Doctor's degree in Photographic Chemistry at London in 1925. From 1919 to 1925 he was a lecturer in inorganic chemistry at the Royal College of Science, and then joined the staff at Eastman Kodak in 1925. While working there he became director of research at Distillation Products, Inc., in 1938. He is currently continuing his researches on the theory of free evaporation and is also serving as chemical consultant for Arthur D. Little Company.

LETTER TO THE EDITOR

"Neglected Lime Producers"

SIR,—Mr. Harold Fletcher's letter is purely a statement of the factors which the limestone producers wish to maintain so as to establish and retain a steady market for their product, but this is not the whole picture. Subsidies are justifiable in cases of national emergency, but should be eliminated as soon as possible if a stable economy is to be achieved. Therefore it is well to look at what will be the problem when the subsidy ceases. The farmer must by now know the value of lime, and will continue to use it if the price is not excessive.

There are two factors of importance in reducing price: namely, local production to avoid heavy freight charges, and the use of a coarser-grained product to reduce grinding costs. The authorities are agreed that the degree of fineness stipulated is quite unnecessary, nor is a pure limestone product required; magnesium limestones containing 6 per cent or more of magnesium carbonate and up to 10 per cent of silica are quite suitable and such occur in many widely-scattered places, particularly in Scotland, and by use of these long haulage charges are cut out.

It should be possible to deliver to farmers in most districts ground limestone, fine enough for all purposes, at a unit price about half that obtaining at present, and still leave a profit for the local producer.—Yours faithfully,

B. G. MCLELLAN, F.R.I.C., M.I.Chem.E.,
Chairman, Limestone Group,
Scottish Council,
(Development and Industry).
22 Granby Road,
Edinburgh 9.

Indian Glass Research

FUNDAMENTAL research in the various branches of glass and ceramics manufacture will be conducted at the Central Glass and Ceramic Research Institute, Calcutta, recently opened by the chief minister of West Bengal, Dr. B. C. Roy. This is the fourth in the chain of research centres to be set up by the Government of India. Other functions of the institute will be testing and standardisation, technical assistance to the existing glass and ceramics industry, and dissemination of information and training of technologists for special work. It has equipment for processing and improving raw materials, particularly glass sands.

HOME

Steelworks Fatality

One man was killed and two others injured on August 31 when a fault developed in the mechanism operating the power for a 1200-tons press at Brown, Bayleys, Steelworks, Ltd., Sheffield. Pressure was unexpectedly released and the men were hurled to the ground. Charles Edward Atkinson, of Baltic Road, Sheffield, received extensive head injuries and died almost immediately.

Food and Drink Poisoning

The large increase of food poisoning cases was referred to by Professor G. S. Wilson, director of the Public Health Laboratory Service, speaking last week at a conference on hygiene held in conjunction with the Food Exhibition at Olympia, London. Despite this increase, the professor said, outbreaks due to chemical poisoning in any single year could be counted on the fingers of one hand.

Technical and Scientific Register, 1949

During the year ending December 5, 1949, the Technical and Scientific Register filled 2212 vacancies and had 5310 persons then registered as available, of whom 3886 were already employed but wished a change of work. During the same period 29,217 vacancies were notified by employers to the appointments offices and 13,311 registrants, of whom 7183 were ex-Service men and women, were placed in employment.

Stolen Lead Ingots

At Huddersfield Quarter Sessions last week William Blackburn, aged 44, scrap metal merchant, of Lascelles Hall, Kirkheaton, Huddersfield, a former member of Kirkburton Urban Council and Sunday School superintendent, was sentenced to 12 months' imprisonment for receiving 28 ingots of lead worth £81, the property of the I.C.I., Ltd., Huddersfield, knowing them to have been stolen. Blackburn pleaded "Not guilty."

New Oil Additive from Fawley

A plant recently completed by the Anglo-American Oil Co., Ltd. on the site of the original refinery at Fawley, Southampton, is now producing the heavy-duty additive for lubricating oils containing barium and sulphur, Paranox 56. The British-produced additive will be known as Paranox 56GB to differentiate it from the American product, which was first introduced in the Standard Oil Company of New Jersey's oils in 1940.

$200,000 for U.K. Electric Motors

Mr. W. W. Grainger, of Chicago, one of the leading distributors of electric motors in the U.S.A., has placed an order with Newman Industries, Ltd., Yate, Bristol, for electric motors to the value of $200,000, for shipment as soon as possible.

Corrosion Prevention

The name of Clear Glass Products, Ltd., has been changed to Corrosion, Ltd. For some time past the company has concentrated all its activities on corrosion problems and particular emphasis is now being laid on the use of new materials and new methods in dealing with corrosion. The policy is to produce materials specifically designed to cope with particular problems.

Fluorescent Inks

A Leeds firm has produced a number of coloured inks from fluorescent substances, which are said to be much brighter than natural colours and have the brilliance of neon lights at considerable distances. The inks may prove to be suitable for textile uses.

Spreading Fertiliser by Air

A demonstration of spreading fertiliser from an aeroplane over marginal land inaccessible to agricultural machinery was given near Plynlimon last week. Distribution of phosphate was found to be slightly more concentrated at the centre of the strip covered than at its edges. The width of the strip was 180 ft. from a height of 400 ft.

A.P.V. Company's Move

The transfer of much of the plant of the A.P.V. Co., Ltd., to the new town at Crawley is expected to take five years. By 1952, however, it is hoped that the company's White City works will have been installed at Crawley, together with two foundries. The company has arranged for its 1400 employees to travel to Crawley during September to see the new houses now being built for them.

Danger of Anti-histaminic Drugs

The need for chemists to warn purchasers of the hazardous nature of anti-histamine drugs, was emphasised by the Birkenhead coroner last week. Speaking after recording the accidental death of a child due to Anthisan poisoning, the coroner said that no warning was issued to the mother that an excessive dose was dangerous to an adult, and even a small quantity was dangerous to a child.

The Stock and Chemical Markets

THE announcement that Imperial Chemical Industries is to raise a further £20 million, this time by the private placing of 4 per cent unsecured loan stock with redemption dates of 1958-1960, did not cause any general surprise. The last accounts showed capital commitments of £23 million and no doubt the rising trend of prices has since meant that more money is required to finance stocks and also the cost of expansion and development work.

It may be recalled that in August, 1948, the company raised over £20 million by an issue of ordinary shares to shareholders at 40s. 6d. per share. No doubt shareholders would have been offered participation in the present new issue had it not been for the uncertain conditions in stock markets which have ruled recently. The new issue is purely a private financial operation and is probably the biggest of its kind that has ever taken place.

There will be no Stock Exchange quotation for the new Imperial Chemical loan stock. After falling to 41s. 6d., Imperial Chemical ordinary units have rallied to 42s. 1½d. at the time of writing, the recovery reflecting general confidence that their 10 per cent dividend will be maintained.

I.C.I. is not, of course, the only leading industrial company which has to raise large sums to provide for expansion and the increased cost of financing stocks owing to the higher prices which have been in evidence ever since devaluation of the £ and have tended to show a sharp up-trend following the Korean war. The City expects that Lever & Unilever will have to raise a substantial sum of at least £15 million before long, partly to provide for larger stocks which will have to be carried following the end of soap rationing, and partly because of the extremely keen competition between the big groups manufacturing the new forms of detergents.

It will be recalled that, as already announced, Albright & Wilson is shortly to raise over £2 million by the issue of 5 per cent preference shares at par to shareholders. The market continues to expect that this important financial operation will meet with success, because the clear 5 per cent yield on the new preference shares is attractive and, moreover, there is to be a share bonus of 100 per cent for ordinary shareholders before the end of the year.

Morgan Crucible plans to make an issue of "fixed and equity" stock in the future. Lever & Unilever ordinary units have remained steady at 40s., and Albright & Wilson 5s. ordinary units have further strengthened to 31s. Monsanto 5s. shares kept firm at 49s. 6d., Laporte Chemicals 5s. units were 10s. 6d. and W. J. Bush £1 ordinary rose sharply to 85s. Lawes Chemical were 10s. 3d., Fisons at 26s. 9d. moved in favour of holders, Brotherton strengthened to 20s., Boake Roberts to close on 30s. and F. W. Berk 2s. 6d. shares were 10s. 6d. Amber Chemical 2s. shares were 3s., Bowman Chemical 5s. 3d., Pest Control shares 6s. 9d., L. B. Holliday 4½ per cent preference 19s. 6d., and Woolley 4¾ per cent debentures kept at 104½.

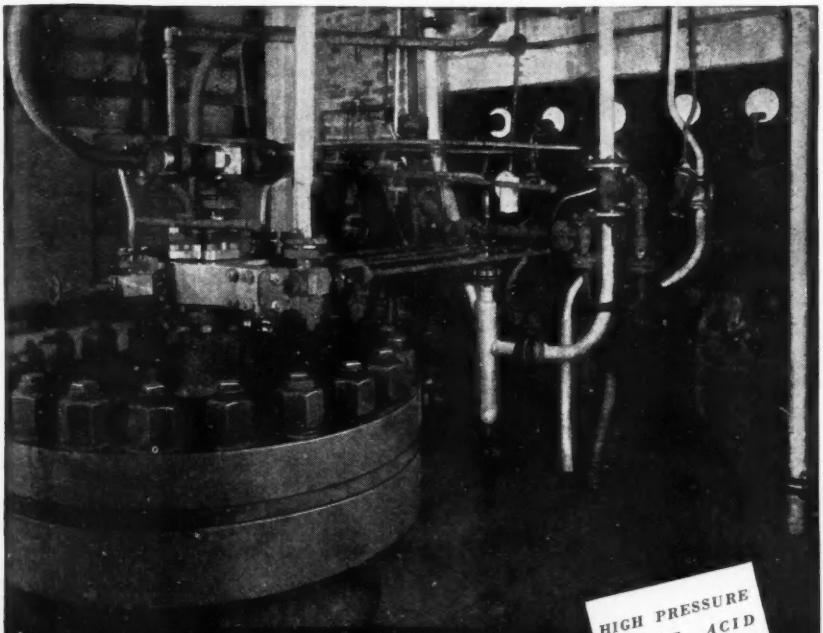
Boots Drug were higher at 49s. 3d., and Beechams deferred good at 13s. 7½d. under the influence of the financial results. Triplex Glass rose further to 27s. United Molasses were higher at 44s. 3d., the 4s. units of the Distillers Co. changed hands around 19s., and Anglo-Iranian, Shell and other leading oil shares have been inclined to move in favour of holders.

Market Reports

QUOTATIONS for industrial chemicals are on a strong basis in almost all sections of the market, the chief price change being a further increase in the quotations for the lead compounds due to the rise in the metal price. The Convention basis price for dry white lead is now £146 per ton and for dry red lead £138 per ton. The overall movement of supplies to the leading domestic users as well as to export outlets has continued to be steady, and pressure for deliveries of some of the routine soda products has been maintained. There is also an active inquiry for contract renewal business. There is a continued good call for most potash compounds, while formaldehyde and hydrogen peroxide are in steady demand. Satisfactory trading conditions are reported on the market for the coal tar products, creosote oil again being in good request for home and export account.

MANCHESTER.—Home trade deliveries for alkalis and other leading heavy chemical products have been made freely on the Manchester market during the past week and conditions seem now to be back almost to pre-holiday level. The number of new inquiries from home users is reported to

(*continued on page* 378)



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19/1

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CITY GLASS CO., LTD., London, S.W. (M., 9/9/50). Aug. 2, £12,000 bond etc., to trs. of late Baron Inverclyde; charged on two plots of land at Denmark Street, Ashfield Street, and Closeburn Street, Glasgow, with bldgs. thereon. *£23,500. June 28, 1950.

THOMAS KERFOOT & CO., LTD., Ashton-under-Lyne, chemists. (M., 9/9/50). Aug. 4, first deb., to Westminster Bank, Ltd., securing all moneys due or to become due to the Bank; general charge (excluding certain ppties.). *Nil. July 14, 1949.

MERCOL PRODUCTS, LTD., Sheffield, chemical mfrs. (M., 9/9/50). July 27, mort., to Barclays Bank, Ltd. securing all moneys due or to become due to the Bank; charged on land with warehouse, storerooms and offices, 47 Eyre Lane, Sheffield. *Nil. Dec. 30, 1949.

MERRIGLO, LTD. (formerly MERRIGLO (PLASTICS), LTD.), London, W., dealers in plastic materials. (M., 9/9/50). Aug. 1, £11,000 debs.; general charge; also Aug. 1, £3000 second deb., to L. N. Henderson, Radlett; general charge. *£12,000. Apr. 10, 1950.

T. H. PRICHARD & SON, LTD., Abertillery, chemists. (M., 9/9/50). Aug. 2, mort., to Halifax Bldg. Soc. securing £700 and further advances; charged on 19 Coronation Street, Blaina. *£2500 (approx.). Sept. 30, 1948.

UPTON OIL CO., LTD., Upton, Poole. (M., 9/9/50). Aug. 4, £2750. deb. to Branch Nominees, Ltd.; general charge. *Nil. May 17, 1949.

Satisfactions

JOHN LYSAGHT, LTD., Bristol, galvanised sheet mfrs., etc. (M.S., 9/9/50). Satisfaction Aug. 4, of deb. stock reg. Aug. 24, 1929, to the extent of £32,258.

MELWOOD THERMOPLASTICS, LTD., London, E.C. (M.S., 9/9/50). Satisfaction Aug. 1, of deb. reg. Jan. 19, 1949.

PHILIP KIRKUP & CO., LTD., Sunderland, grease, oil and varnish mfrs. (M.S., 9/9/50). Satisfaction Aug. 8, of mort. reg. Dec. 20, 1928.

Receivership

WIMPOLE LABORATORIES, LTD., cosmetic manufacturers and dealers, etc., Garden Street, Walsall. (R., 9/9/50). Mr. Andrew F. Dawes, 15 Calthorpe Road, Edgbaston, Birmingham, was appointed receiver and manager on August 17, 1950, under powers contained in debentures dated June 30, 1949.

Company News

Beecham Group, Ltd.

The trading profit of the Beecham group for the year ended March 31, 1950 was £2,427,430, compared with £1,816,843 for the previous year. The income from sales was £20,926,159, of which £2,427.430 was distributed. Of the latter figure, £1,361,759 was required for tax and £356,896 was retained for additional working capital. The surplus attributable to members of Beecham Group, Ltd., was £836,771, compared with £663,223 the previous year.

Triplex Safety Glass Co., Ltd.

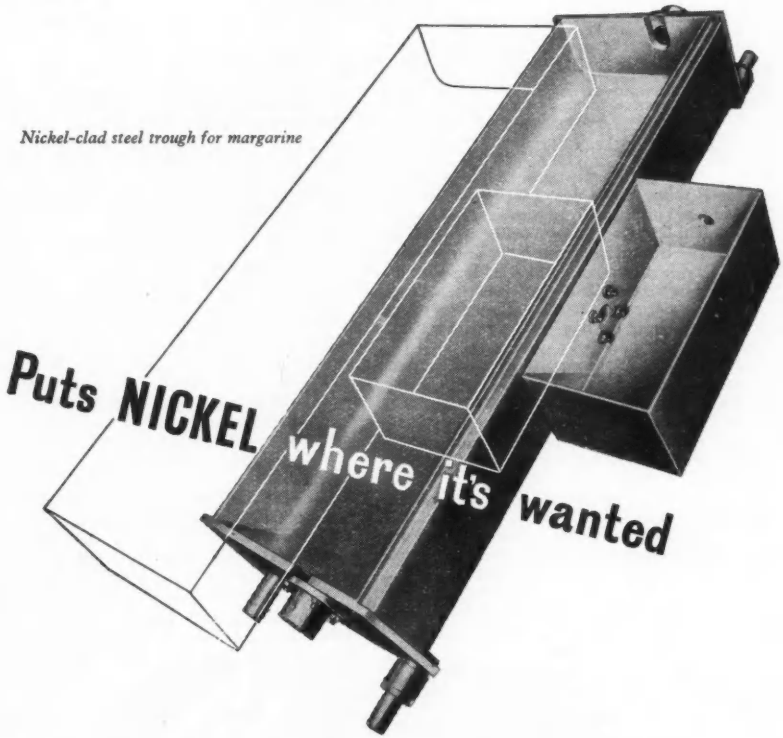
The group trading profits of the Triplex Safety Glass Co., Ltd., for the year ended June 30, 1950, amounted to £278,849, compared with £244,272 for the previous year.

THE STOCK AND CHEMICAL MARKETS

(*continued from page 376*)

have been fairly good and export business has been maintained at recent levels. Further stiffening in prices of lead and copper compounds has resulted from the movements in the metals.

GLASGOW.—There has been considerable activity and a general increase in orders in the Scottish heavy chemical market. Exports, however, have slowed up considerably owing to the fact that most of the home works are fully committed and fewer chemicals are available.



Nickel-clad steel trough for margarine

NICKEL-CLAD STEEL

The necessity to avoid contamination in food manufacturing equipment often calls for the use of pure nickel. And when the size is too big to make pure nickel practicable, nickel-clad steel may be a satisfactory alternative.

Further information is available from:—

THE MOND NICKEL COMPANY LIMITED, Sunderland House, Curzon Street, London, W.1

12/NC/1

Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2, at 2s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Recovery of fluosulphonic acid.—United States Rubber Co. May 14 1948. 643,824.

Recovery of fluosulphonic acid.—United States Rubber Co. May 14 1948. 643,825.

Lenses.—Imperial Chemical Industries, Ltd., C. E. Coulman and G. R. Petrie. May 27 1949. 643,938.

Joining of sand cores.—Foundry Services, Ltd., and K. Strauss. May 19 1949. 643,778.

Organo-silicon compounds. — British Thomson-Houston Co., Ltd. June 9 1948. 643,941.

Compositions of olefinic polymers and polymeric 4-vinylcyclohexene dioxide.—Canadian Industries, Ltd. June 29 1948. 643,950.

Purification of acetic anhydride.—British Celanese, Ltd. July 30 1948. 643,700.

Feed heating and feed distribution in forced circulation water tube steam boilers.—La Mont International Association, Ltd., and F. W. Bower. March 31 1948. 643,840.

Bonding of abrasive bodies by means of synthetic resins.—Montclair Research Corporation. March 23 1945. 643,964.

Filters for air or other gases.—Hall & Kay, Ltd., S. Hall and A. Myers. March 26 1947. 643,971.

Production of phenanthridine compounds.—May & Baker, Ltd., and H. J. Barber. Dec. 24, 1947. 643,974.

Fluorescent textiles.—J. L. Switzer and R. C. Switzer. April 16, 1946. 644,201.

Method for destructive distillation of fuel in retort furnaces and means for carrying out the method.—D. Dalin, T. J. Hedback, C. J. Gejrot and A. W. Johansson. July 15 1946. 644,203.

Thermo-injecting moulding press and process.—Defiance Machine Works, Inc., and K. W. Hall. Aug. 2 1946. 643,980.

Piezo-electric apparatus.—Philips Lamps, Ltd. Sept. 5, 1946. 643,983.

Methods of forming particulate-coated articles and the particulate-coated articles resulting from said methods.—Minnesota Mining & Manufacturing Co. Feb. 12 1947.

Production of carburetted water gas.—Imperial Chemical Industries, Ltd., and G. Nonhebel. Feb. 27 1948. 644,004.

Production of shaped articles of polytetrafluoroethylene and copolymers thereof.—E. I. du Pont de Nemours & Co. March 28 1947. 644,008.

Quinoxalines and derivatives thereof.—Merck & Co., Inc. May 7 1947. 644,016.

Manufacture of 3:4-dichloro-1-tetrachlorethyl-benzene.—Ciba, Ltd. May 13 1947. 644,021.

Method of preparing rubbery vulcanisable polymeric materials.—B. F. Goodrich Co. May 19 1947. 644,022.

Method and apparatus for discharging solid fuel from retorts.—Low Temperature Carbonisation, Ltd., J. P. Postlethwaite and J. W. Harley. May 19 1948. 644,023.

Partial oxidation of hydrocarbons.—Clark Bros. Co., Inc. May 30 1947. 644,027.

Aqueous cooling solutions for use in the machining of metals.—Lubrefor. June 6 1947. 644,029.

Production of carbon disulphide.—Pure Oil Co. June 11 1947. 644,030.

Glassware annealing lehrs.—Hartford-Empire Co. July 8 1947. 644,036.

Mineral oil composition. — Socony-Vacuum Oil Co., Inc. July 14 1947. 644,043.

Processes for preparing high molecular weight condensate resins or polymers, and the compositions resulting therefrom.—Monsanto Chemical Co. July 18 1947. 644,046.

Preparation of drying oils having a conjugated system. — Raybestos-Manhattan, Inc. July 23 1947. 644,049.

Methods and apparatus for moulding plastic material.—K. P. Billner. July 24 1947. 644,132.

Process of manufacture of 2, 2-bio-(4-methoxyphenyl)-1, 1, 1-trichloroethane.—E. I. du Pont de Nemours & Co. July 29 1947. 644,051.

Stable pharmaceutical preparation.—V. Kitter. Aug. 1 1947. 644,054.

Welding of non-metallic thermoplastic materials and the fabrication of products therefrom.—Udylite Corporation. Aug. 7 1947. 644,057.

Process of obtaining chorionic gonadotropic hormone.—President and Board of Trustees of St. Louis University. Aug. 7 1947. 644,060.

Processes employing fluidised powdered catalyst or contact material.—Standard Oil Development Co. and C. Arnold. Aug. 26 1947. 644,135.

Methods of contacting gases and finely divided solids.—Compagnie Industrielle de Procedes et D'Applications Soc. Anon. Sept. 16 1947. 644,138.

Method of preparing phthaloyl chlorides.—Wingfoot Corporation. Oct. 1 1947. 644,071.

Solid gas-generating charges.—Imperial Chemical Industries, Ltd., and A. C. Hutchison. Aug. 11 1948. 644,073.

Means for controlling the temperature of hot gases.—J. Lucas, Ltd., R. J. Ifield and O. N. Lawrence. Oct. 1 1948. 644,140.

Formation of metallic films by thermal evaporation. — Polytechnic Institute of Brooklyn. Oct. 31 1947. 644,077.

Production of streptomycin.—Distillers Co., Ltd., C. J. Jackson and J. Milner. Nov. 3 1948. 644,078.

Pectin products and the process of making same.—H. Welch. Nov. 25 1947. 644,081.

Apparatus for drying and heating powdered granular or like substances. — Conreur, Sahut & Cie. Dec. 30 1947. 644,093.

Casting of chromium alloys.—Power Jets (Research & Development), Ltd., T. A. Taylor and N. Stephenson. Feb. 3 1949. 644,094.

Phenthiazine derivatives. — Soc. des Usines Chimiques Rhone-Poulenc. Jan. 19 1948. 644,101.

Preparation of derivatives of tropine.—Wellcome Foundation, Ltd., and D. W. Adamson. Feb. 4 1949. 644,115.

Methods of and apparatus for cleaning, rustproofing, prime coating and spray painting sheet metal articles such as vehicle bodies.—Carrier Engineering Co., Ltd., and A. P. Fowler. March 8 1949. 644,169.

Spraying of metal powders. — Schori Metallising Process, Ltd., and R. Dickinson. March 23 1949. 644,218.

Diazotype photoprinting layers having cyan acetyl amides as azo coupling components.—General Aniline & Film Corporation. June 4 1948. 644,186.

Holders or containers for small ferromagnetic articles.—Jessop & Sons, Ltd., and D. Hadfield. June 29 1949. 644,194.

Connection of valves to fluid conduits.—British Oxygen Co., Ltd., G. F. Arcus and G. D. Black. June 17 1949. 644,237.

Revivification of metallic hydrogenation catalysts.—E. B. Maxted. Aug. 6 1949. 644,239.

Burning of cement in rotary kilns.—C. E. Every (Smidth & Co., F. L. Aktieselskabet,). July 29 1948. 644,247.

Photographic developers.—May & Baker, Ltd., D. H. O. John and G. T. J. Field. July 31 1948. 644,249.

Apparatus for the biological properties of air in rooms.—Hydro-nitro Soc. Anon. Sept. 1 1949. 644,264.

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CLASSIFIED ADVERTISEMENTS

SITUATION VACANT

THE Civil Service Commissioners invite applications for permanent appointments as **ASSISTANT EXPERIMENTAL OFFICER** to be filled by competitive interview.

The posts are in various Government Departments and divided between following main groups and subjects (*a*) Mathematical and Physical Sciences, (*b*) Chemistry and Metallurgy, (*c*) Engineering Subjects and (*d*) Miscellaneous (including e.g. Library and Technical Information Services). No further applications can be accepted from Biologists, Geologists or Meteorologists.

Interviews will be held throughout the remainder of the year, but a closing date for the receipt of applications earlier than December, 1950, may eventually be announced either for the competition as a whole or in one or more subjects.

Candidates must be at least 17½ years and under 26 years of age (or under 31 for established Civil Servants of the Assistant (Scientific) Class) on 1st August, 1950; time spent on a regular engagement in H.M. Forces may be deducted from actual age. Candidates must have obtained the Higher School Certificate with mathematics or a science subject as a principal subject, or an equivalent qualification; but candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. Higher qualifications will be regarded as an advantage to candidates over the age of 20.

The inclusive London Salary Scale (men) is £230-£490. Salaries for women and for posts in the provinces are somewhat lower. Superannuation provision is made under the Superannuation Act.

Further particulars and forms of application from the **Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1., quoting No. 3068.**

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INDIAN **TECHNICAL GRADUATE** in **CHEMISTRY** wants paid apprenticeship in a British Chemical Firm and will work as representative in India or in any other service after training. Box No. C.A. 2949, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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THE CRACK PULVERISING MILLS, LTD.,
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GRINDING, Drying, Screening and Grading of materials undertaken for the trade. Also Supplier of Ground Silica and Fillers, etc. JAMES KENT, LTD., Millers, Fenton, Staffordshire. Telegrams: Kenmill, Stoke-on-Trent. Telephone 4253 and 4254, Stoke-on-Trent (2 lines).

GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hilljones, Bochurch, London." Telephone: 3285 East.

FOR SALE

VARIOUS MIXERS FOR SALE

BAND CONVEYOR, 50 ft. long 40 in. wide, steel frame, motorised, for boxes, cases, bags, etc.

A FILTER PRESS, 31½ in. square, fitted with 42 C.I. plates, centre fed.

FILTER PRESS, 25 in. square, fitted with 24 plates, cast iron built and steam heated.

Four **GARDNER HORIZONTAL MIXERS,** for powders, from 100 lbs. to 250 lbs. capacity, all motorised, three with Radicon Reduction Gear Boxes and one with a Spur Gear Drive.

Two large unjacketed **WERNER MIXERS,** belt and gear driven, hand tipping, double "Z" arms, pans 53 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw.

No. 204 One **WERNER PFLEIDERER MIXER OR INCORPORATOR,** similar to the above, with a C.I. built pan 25 in. by 25 in. by 19 in. deep, belt pulleys 26 in. diam. by 5 in. face, double fin-type agitators, and mounted on C.I. legs.

No. 208 One **DITTO** by **WERNER PFLEIDERER,** with a C.I. built pan or mixing chamber, of the double "U" type, 4 ft. 5 in. long by 3 ft. 8 in. by 33 in. deep, with double "Z" mixing arms, gears at each end, hand-operated tilting gear, with steel backframe, counterbalancing weights and chains, and fast and loose pulleys 3 ft. diam. by 6 in. face.

No. 209 One **HORIZONTAL "U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

No. 211 One **HORIZONTAL MIXER** as above.

These three "U"-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

Further details and prices upon application.

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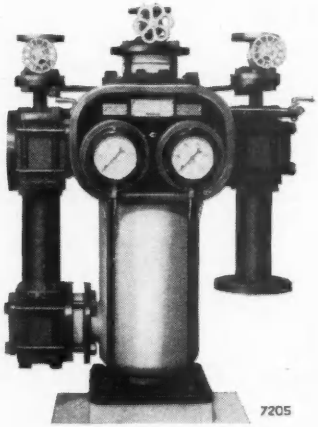

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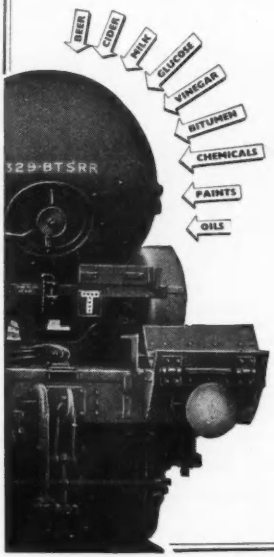

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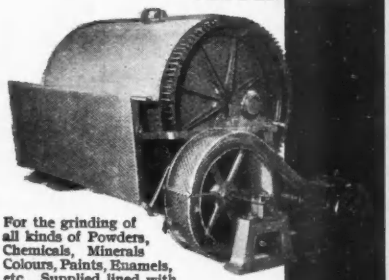

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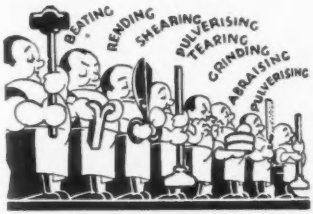

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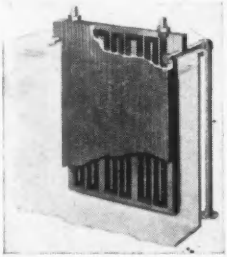

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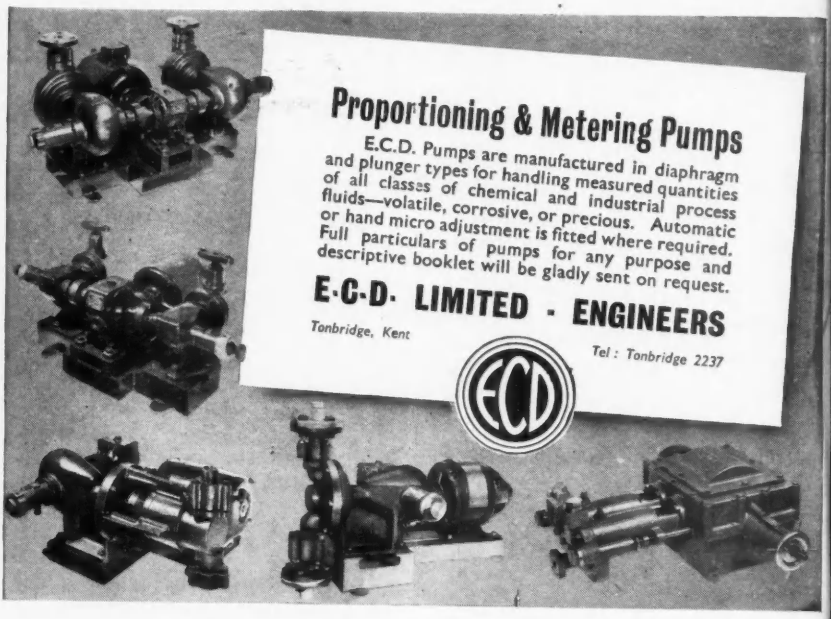
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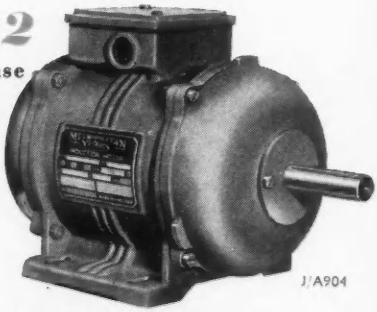

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